the OIL AND GAS JOURNAL

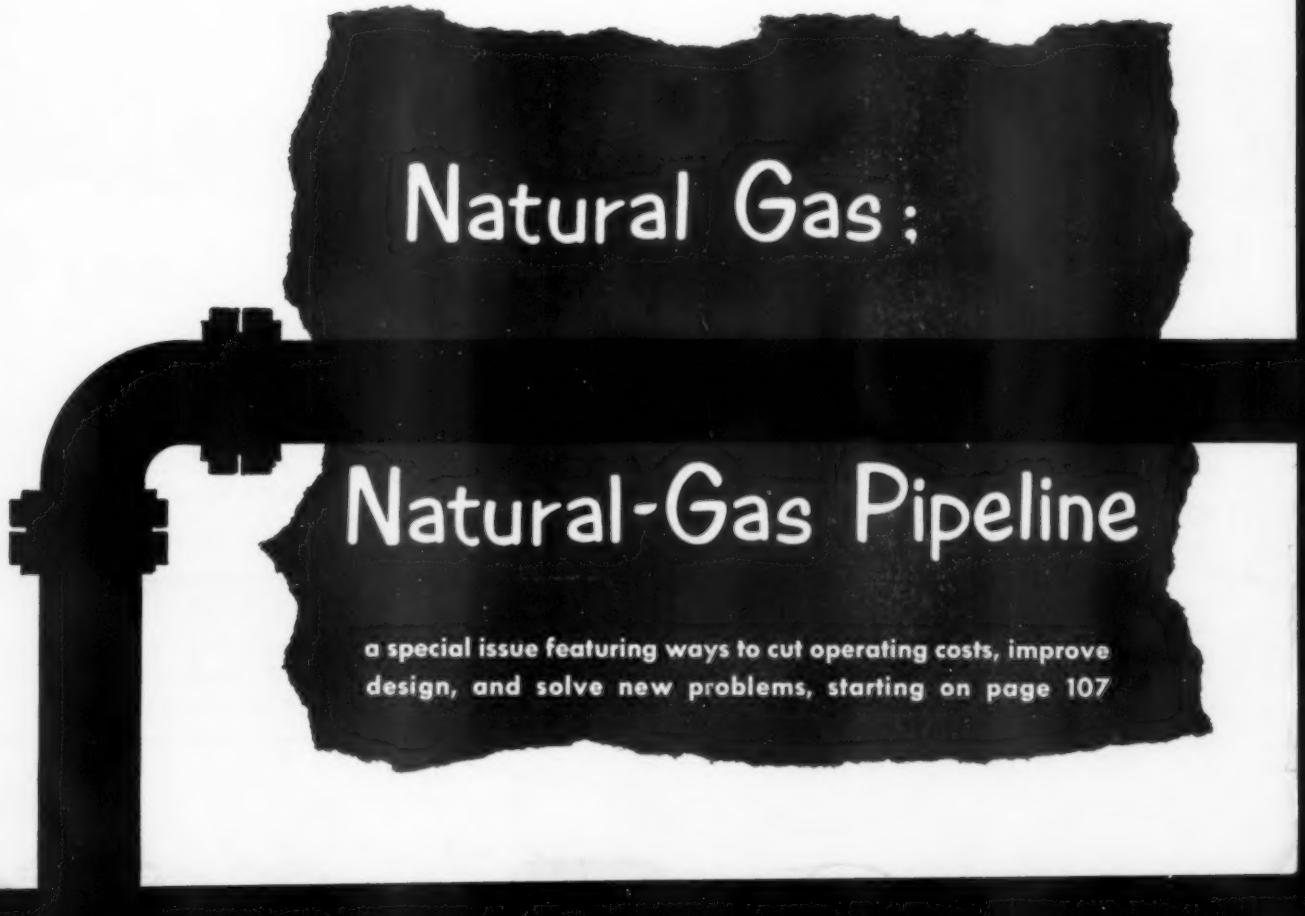
MARCH 10, 1958

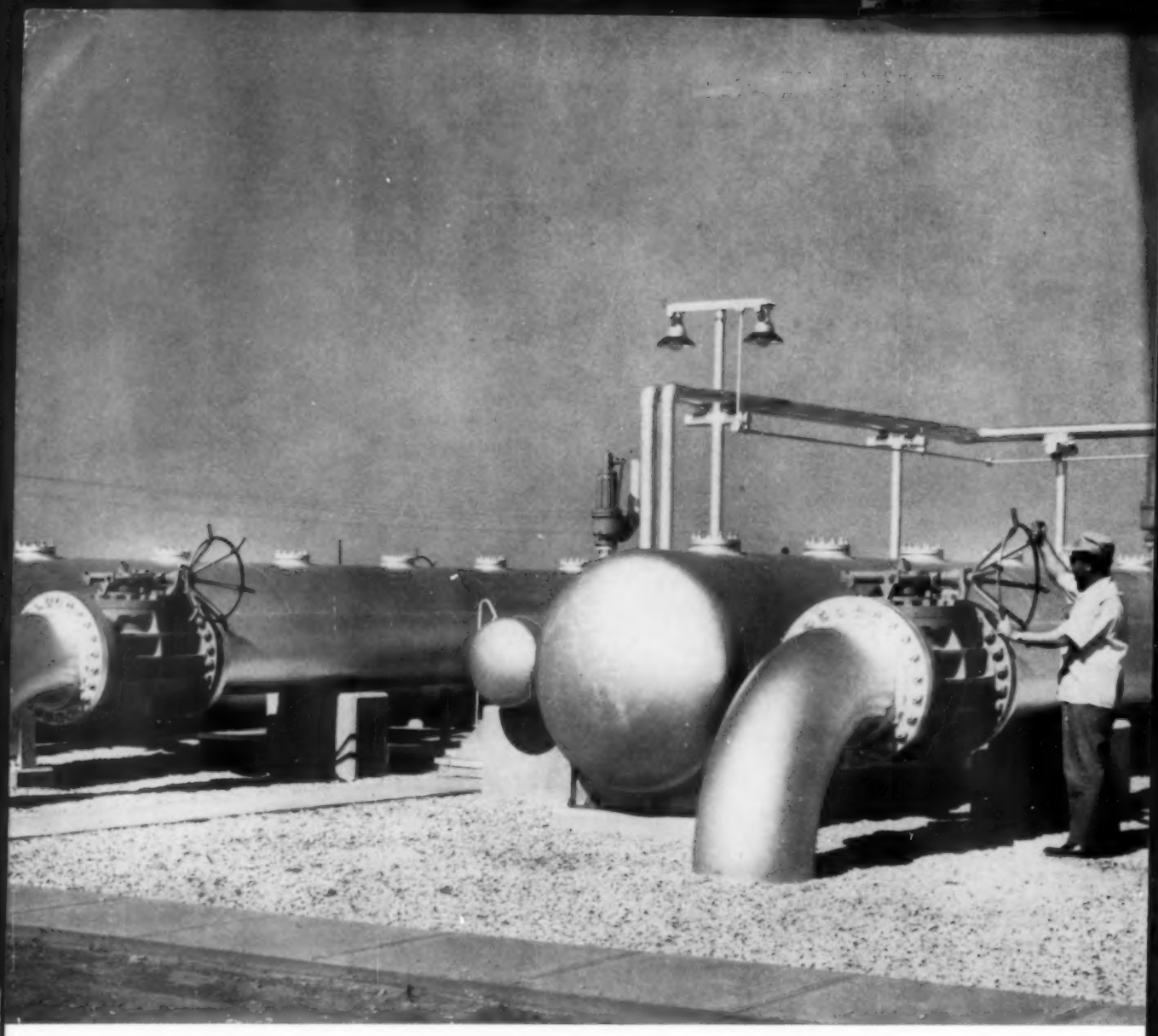
Crude Prices Depend on Two Big "Ifs" p. 81

Needed: Adoption of Uniform Oil Reports p. 84

Insert: Three New NPC Pipeline Maps

. . . Patterns and Capacities


Natural Gas:
Natural-Gas Pipeline
a special issue featuring ways to cut operating costs, improve design, and solve new problems, starting on page 107



CLOSES IN MINUTES . . . NOT HOURS!

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While the stem in ordinary valves must be "wound" through hundreds of turns to bring together and set the metal-to-metal seats, a Rockwell-Nordstrom valve is full open or full closed when the plug is rotated through only 90°. This quarter-turn operation is much easier because the plug rotates on a film of lubricant. And, the combination of the firmly seated tapered plug and the unique seal of pressurized lubricant assures really positive shut-off.

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ROCKWELL-Nordstrom VALVES

it's **ROCKWELL**

MANUFACTURING COMPANY

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 10, 1958

New statistics show the tremendous growth in natural gas:

Figures reveal that since World War II:
...Natural gas supplies 55 per cent as much energy as all petroleum products.
...Drillers have found more gas and liquids than oil.
...Gas and gas-liquids production have increased almost as much as crude production plus imports since 1945 (p. 107).

This gas expansion is raising two big questions on:
...Prices. Is the producer getting enough for gas?
...Competition. Is gas hurting oil?

Many oil and gas men sincerely believe gas is underpriced and not bearing its share of joint exploration and producing costs with crude.

New information is shedding more light on prices (p. 110). There is no single price for gas, but for first time the figures reveal how distance from market, volume of reserves, and other factors affect the price.

Weight of opinion in the industry holds that gas is now one of oil's biggest competitors and is crowding crude out of some markets. One major producer, however, told the Journal last week he didn't think gas is stealing old crude markets but conceded it certainly is limiting growth in oil demand.

An import development worth watching is Gulf's plans to bring in unfinished gasoline from Kuwait.

Gulf is importing about 266,000 bbl. of this product in March, plans to step this up to 12,000 bbl. daily in April and 25,000 bbl. daily in May. The product is coming from a new Gulf processing plant in Kuwait.

Internal Revenue has ruled the unfinished gasoline will pay import duty of only ¼-cent a gallon rather than 1¼-cent imposed on gasoline.

Producers should be alerted to another possible change in purchaser practices.

There's talk that some buyers are studying a policy of paying the producer a lump sum for oil bought from a lease. The producer then would have to pay the royalty holders.

West Coast buyers now follow this practice. Purchasers

in the Mid-Continent and Southwest, however, stand the extra bookkeeping and legal expense of handling royalty checks for the producer.

Many buyers have long chafed at this expense. Now that West Coast and eastern operators are competing in such spots as the Four Corners, they say this practice puts the oil they buy in an unfair competitive position.

The talk emphasizes a trend: Oil men these days are scanning their entire operations for ways to cut costs. A controversy, for instance, still waxes hot in Oklahoma over Kerr-McGee's move to pass on gathering charges to producers.

The API's annual report on reserves comes out this week. It'll show we used more oil and gas-liquids than we found last year. Reserves of crude and gas-liquids, as a result, will be down; gas up.

Factors hurting crude reserves: Less drilling last year and fewer good discoveries.

Proration notes: Look for Louisiana to place allowables on condensate produced from gas wells. Conservation officials claim both natural gas and condensate are cutting into demand for crude oil...Texas producers may not return to 15-day producing months for a long time. One southwestern oil operator predicted privately last week that when present industry crisis is over normal production in Texas will be only 12 days and will stay there for a spell.

Wyoming explorers are making some good strikes.

In the Green River basin, Ohio Oil's 1 Wamsutter Unit flowed 4,000 M.c.f. of gas daily. The wildcat may be a major gas strike in a remote wildcatting area of the basin.

El Paso Natural also reports gas shows at its well confirming recent Desert Springs Unit Mesaverde discovery. If this well hits, it will establish a 1½-mile long band of Mesaverde gas production.

In Powder River basin, the best oil producer yet has been tested in Dead Horse Creek field by California Co. Its 7 Government pumped 459 bbl. daily from Parkman-Mesaverde.

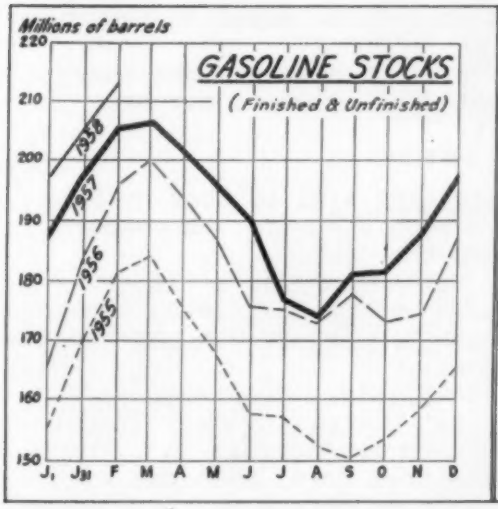
A busy gas province is developing in Woodward County, northwestern Oklahoma (p. 92).

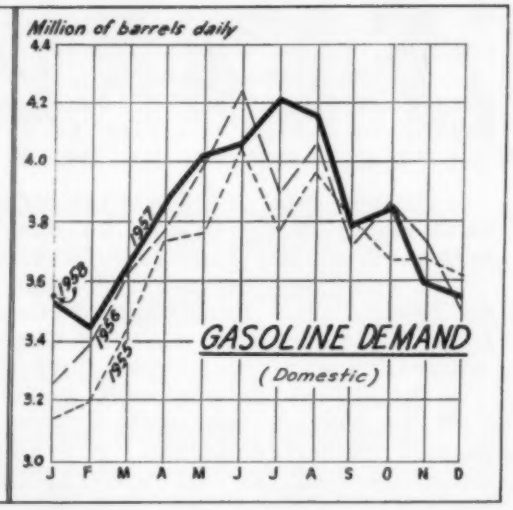
Only 14 months ago the county had no production and very little prospects. Last week Calvert Drilling brought in the seventh gas field in the county. Success has been fast since Union Oil discovered Woodward's first Precambrian field.

Chicago will get new supplies of gas next winter.

That's result of decision by Peoples Gas to drop its opposition to the Midwestern project (p. 90).

Midwestern expects an early go-ahead on southern section





WATCH THE GASOLINE MARKET this spring.

It will tell whether crude prices can hold.

If the market moves up, prices are safe.

Here's why gasoline suddenly is so important: The refiner must halt the recent disastrous decline in his per barrel realizations. If he doesn't, his only choice is to cheapen the price of crude (p. 81).

Gasoline now is the only product the refiner has to work on. It's too late for even more cold weather to change the price picture much for heating oils. The season is made.

This means refiners need an early motoring season—and a brisk one—to get gasoline moving. But a good price also must prevail.

Prices will depend on demand, which can only be guessed, and a stock level that is within the normal range. Something can be done only about stocks.

The charts above show the supply-demand relationship:

... **Stocks** are high and heading up in 1958. The trend is normal but the range now out of joint. For the last 3 years the motoring season has ended with stocks high, and the winter build-up each time has been made on a higher base.

... **Demand** has been spotty with the expected increase failing to show in 1957.

Some economists figure recent cuts in allowables and refinery runs should be geared to drop gasoline stocks 8,000,000 bbl. this month for a healthy gasoline season.

Even then any abnormal dip in gasoline demand can spell trouble.

---

of its Tennessee-to-Canada line that will serve Chicago. Opponents to the northern leg still have not been placated.

Key to decision by Peoples Gas to drop fight is Memphis decision. That ruling killed its plans for the Beatrice project to expand service to Chicago. Midwestern, being a new company, does not face the Memphis blues since rate agreements were written in original contracts.

Automation is changing the economics of pump-station spacing for large-diameter crude pipelines.

Tapline engineers report that success of unattended gas-turbine units in Saudi Arabia means that stations will be placed closer together. More distant spacing had been used to save money. In the Middle East each manned station involves setting up an entire community.

Here's one for a laugh. It shows what pipeline engineers working abroad can run into.

On one foreign project, politicians have decided where they want the pump stations located. Engineers now are having to design the line to fit.

Design work on Algerian crude line will be done by Pipe Line Engineering Co. of Dallas. Bennie Bender, Shreveport, promoter of the line has retained the firm.

Bender has formed a company for the project. It'll be an 18-in. line from Hassi Messaoud and Edjele fields through Libya to Tripoli. Also in the venture are French and American interests and the Libyan Government.

Construction contract is held by River Construction Co.

The French, meanwhile, are just now moving their first tanker of Saharan oil. Oil has been moving only in driblets over the hastily-built 6-in. line from Hassi Messaoud to railhead at Touggourt. Rebels have made rail movement from there to the coast very hazardous.

Refiners will be interested in details of how OCAW plans to cut its members in for share of oil-industry production.

Each employer will pay small royalty on each physical unit of production. Payments will be invested in a carefully selected portfolio of securities. Workers will be credited with their proportionate share. Plan will be administered jointly by OCAW and management (p. 88).

Day of wholly owned natural-gasoline and cycling plants is about over.

Gas producers no longer are willing to sell their gas to another producer to process and sell. They want to participate in profits of the plant.

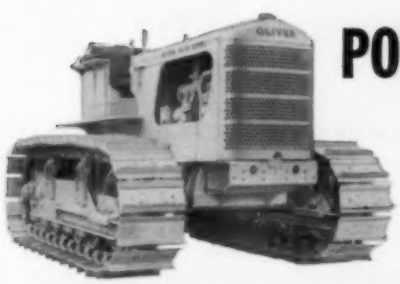
Changing marketing trends, however, are deemphasizing natural gasoline itself, regional meeting of NGAA heard at Odessa, Tex. If it were not for residue gas and LPG sales, most natural-gasoline plants would be running in the red.

Refining notes: LPG-storage construction will pick up next summer. Recent cold spell depleted earthen storage and taxed industry to meet emergency. LPG supplies were trucked to Florida from as far as Louisiana, Texas, and Oklahoma... Eastern States is best bet for first refiner to install Alkar, new process for alkylation of aromatics.

In Washington: Carson says voluntary imports program is working successfully...Iran's ambassador has been called home. His idea for pooling the Middle East's oil income and spreading the wealth got a sour reception in Teheran... Kermit Roosevelt, grandson of Teddy, will be Gulf Oil's new director of governmental relations.

OLIVER

OLIVER OC-12 CRAWLER TRACTOR



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the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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NATURAL GAS—GAS PIPELINE

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Advances in Gas Pipeline Technology in 1957 115
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Colorado Interstate Operates Its Own Central Machine Shop . . . 128
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By Henry Lippitt II
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Engine-Driven Centrifugal-Compressor Units for Downstream Stations . . . 160
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How to Reduce Surge and Valve Losses . . . 170
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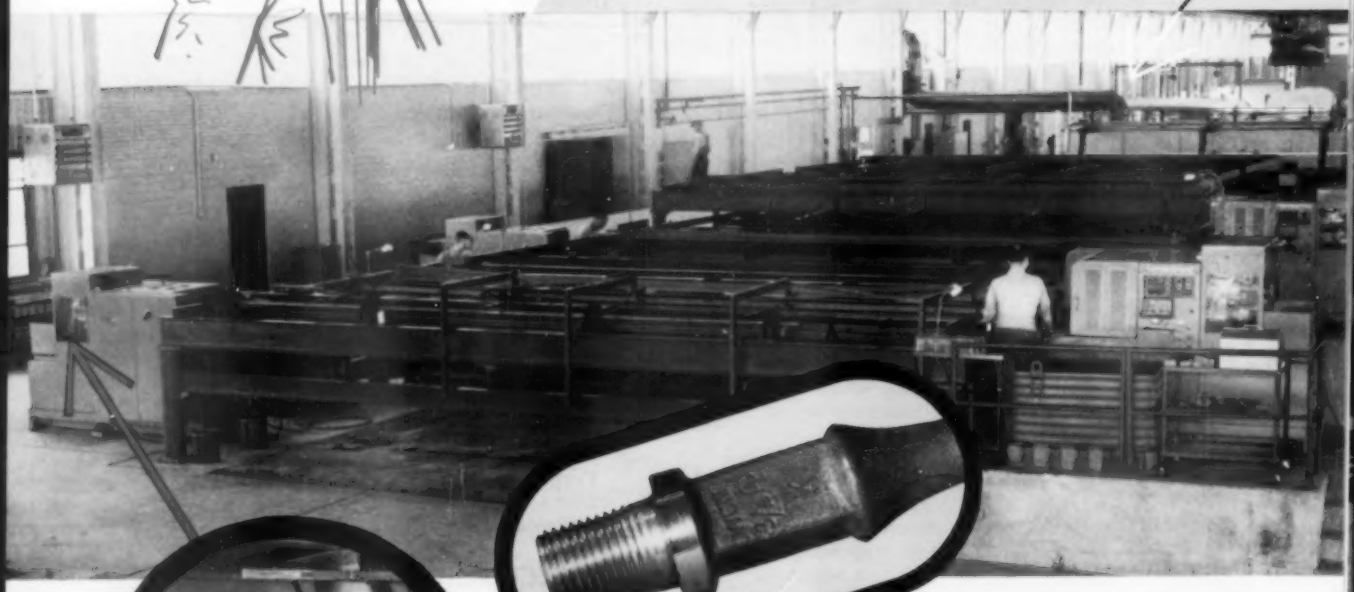
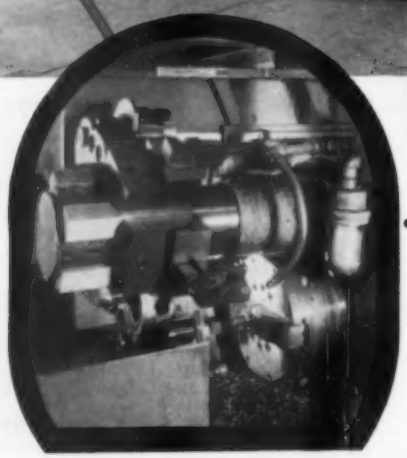
SUPER SENSITIVE *AUTOMATIC* THREADING* AND FINISHING PROVIDES UTMOST *UNIFORMITY*

**Grandpa could put a darn good thread on a buggy axle but it wouldn't pass inspection here.*



UNRETOUCHED FINISHED ROD END



Close-up of machine with automatic chucking-devices finishing rod end in four steps.

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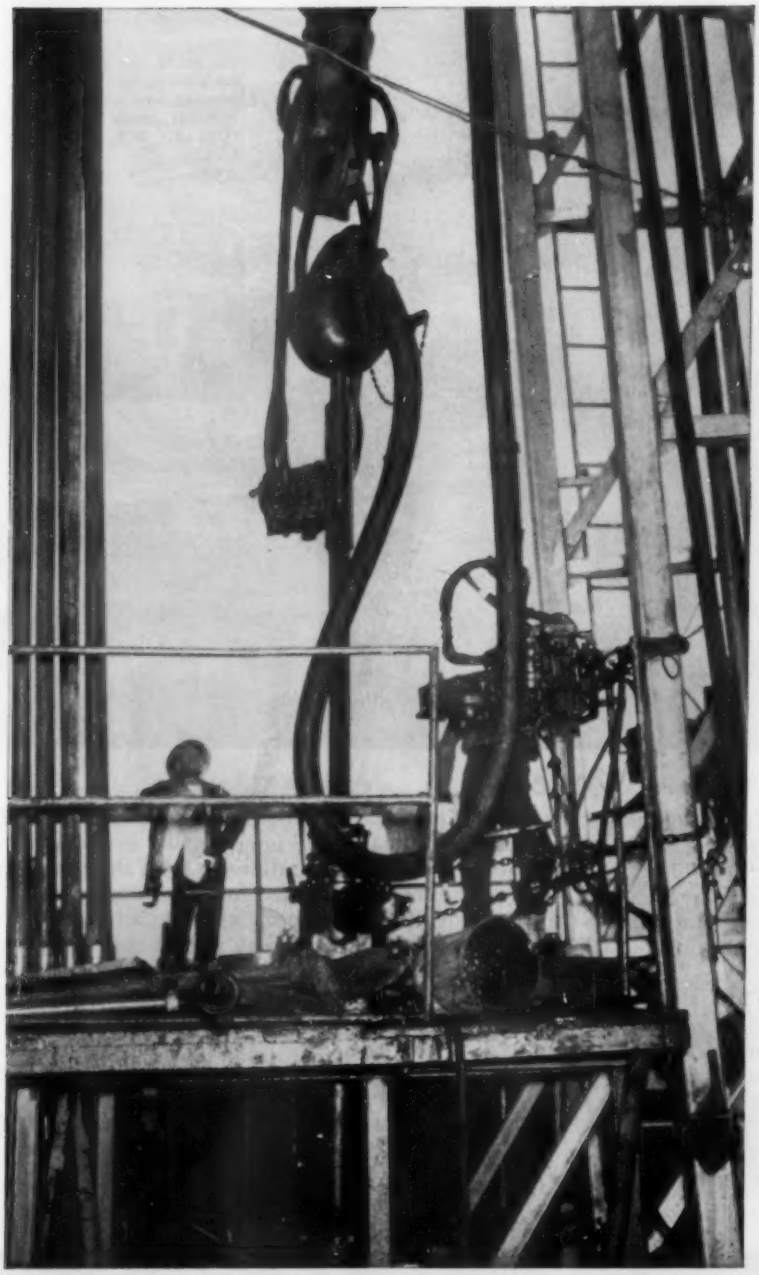
20% saved when rubber hose replaces steel on workover rig



B. F. Goodrich improvements in rubber brought extra savings

Problem: This special aluminum portable drilling rig is used in servicing wells —cleaning them out, cutting plugs, removing lost iron or steel. Because of the rugged service, a steel rotary hose was used at first. But it was built in sections. Expensive time was wasted in assembling the metal hose every time the rig was put into operation.

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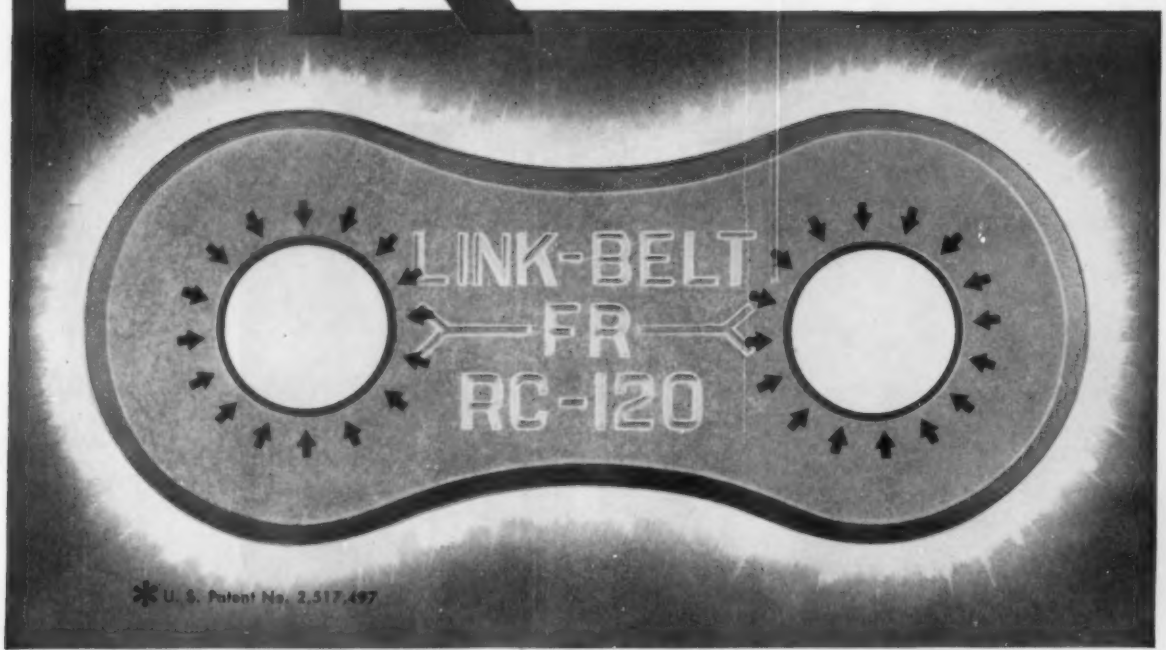

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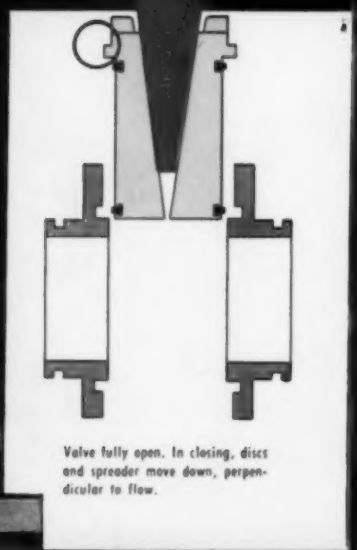
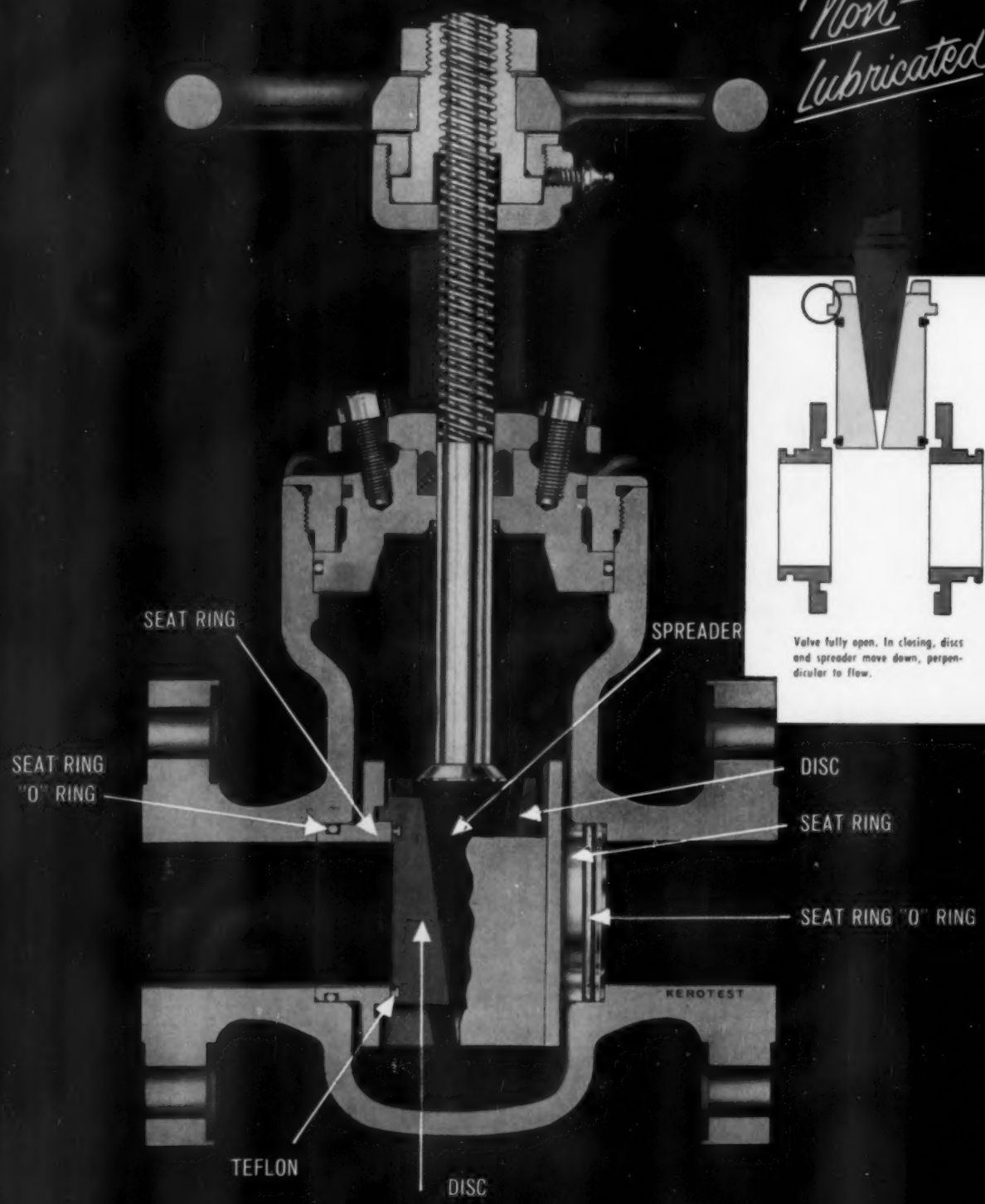
This NEW vapor-tight, optional flow,

Non-lubricated



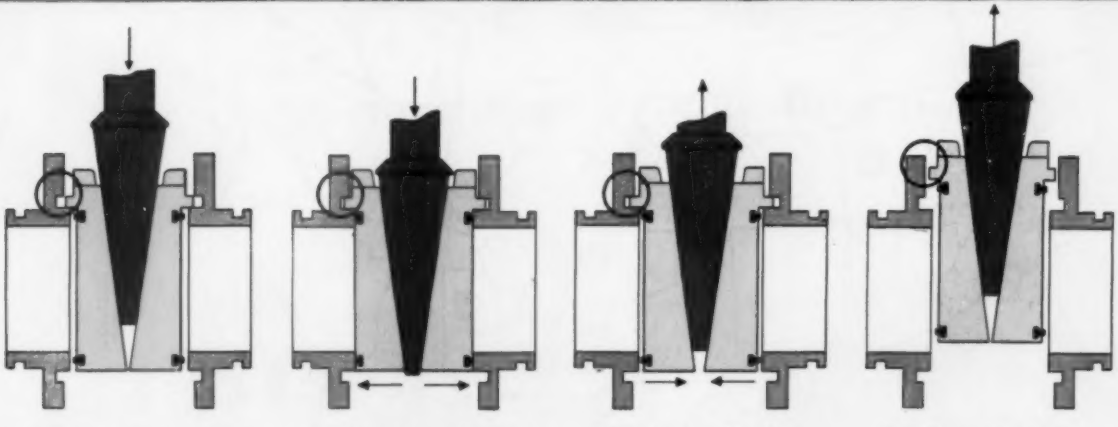
Valve fully open. In closing, discs and spreader move down, perpendicular to flow.



double block and bleed, full opening,

KEROSEAL® VALVE

handles gases, petroleum products and petrochemical fluids



Discs are positioned without drag across seat. When disc lug rests on seat ring, continued downward motion of spreader moves discs parallel to flow.

Valve fully closed. Spreader holds discs vapor-tight against seat rings.

Valve begins opening. Seated discs are retracted with the same parallel motion—again with no drag against seating surfaces.

Discs fully retracted, and assembly rising. Upward motion does not begin until discs are clear of seat ring.

More than two years of laboratory and field testing have clearly demonstrated the fact that the new KEROSEAL offers advantages not found in any other valve.

The KEROSEAL valve gives a vapor-tight seal without the continued and costly use of sealing lubricants. An effective new method of guiding the disc assembly, completely independent of the valve body, maintains clearance between discs and seat rings during operation, eliminating wear, frictional drag, wiping, and consequent galling of the seating surfaces.

Primarily, these advantages are the result of an entirely new principle of operation. The stem carries a spreader, on which are mounted a pair of discs. A Teflon sealing ring is mechanically bonded to each disc.

When the valve is being closed, the discs move downward, without friction. This downward travel automatically ends when discs are correctly positioned in relation to the seat ring. At this point, further movement of the stem initiates the spreader action, forcing the discs against the seat rings.

In opening, the first movement of the stem retracts the discs so that they clear the seat rings, and further movement raises the discs until they reach the fully open position.

The new KEROSEAL valve is described in detail in this new full-color bulletin. *Write for your copy today.*

KEROTEST

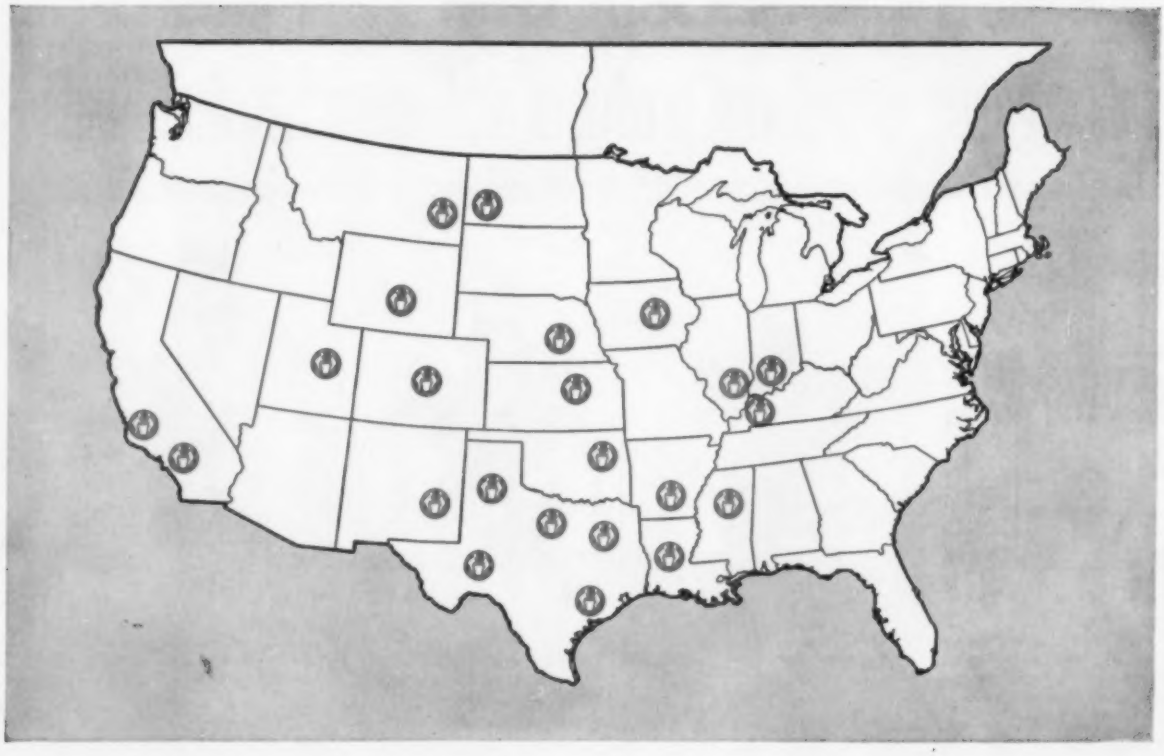
KEROTEST MANUFACTURING COMPANY

2512 Liberty Avenue, Pittsburgh 22, Pa.

In Canada, Kerotest products are manufactured and distributed exclusively by Guelph Engineering Company, Guelph, Ontario.

Patent Applied For

Financing from the **FIRST** *in Dallas goes where you go!*



Specialized experience, organization, and resources to help you with practically any kind of need for "working money".

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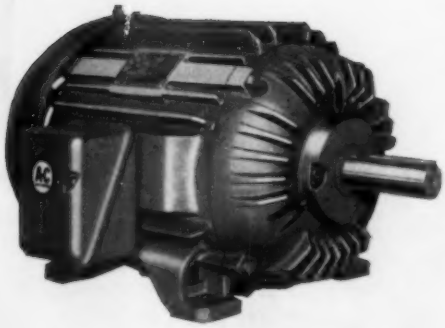
GIVE US AN OPPORTUNITY TO SAY · YES ·

put FIRST financing in your own oil future



long-run power by Allis-Chalmers

If you specify "Allis-Chalmers motors or equal"

. . . remember that the "equal" is possible only in two respects: price and nameplate specifications. You can't match the *long-run power* of Allis-Chalmers motors.

Double-shielded bearings guarded against dirt and over-greasing . . . provision for elimination of moisture condensation . . . practically indestructible rotor design . . . more cooling surface . . . more iron and copper content — these are the features (with others) that make up long-run power. These are the features that give Allis-Chalmers motors "plus" performance that can't be equalled.

Find out more about the motors with long-run power from your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5663

Can you afford to miss the pay?

HOMCO Directional Drilling keeps you "on target" all the way down.

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY, INC.
HOUSTON, TEXAS

DIVISION OF THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

RESEARCH • ENGINEERING
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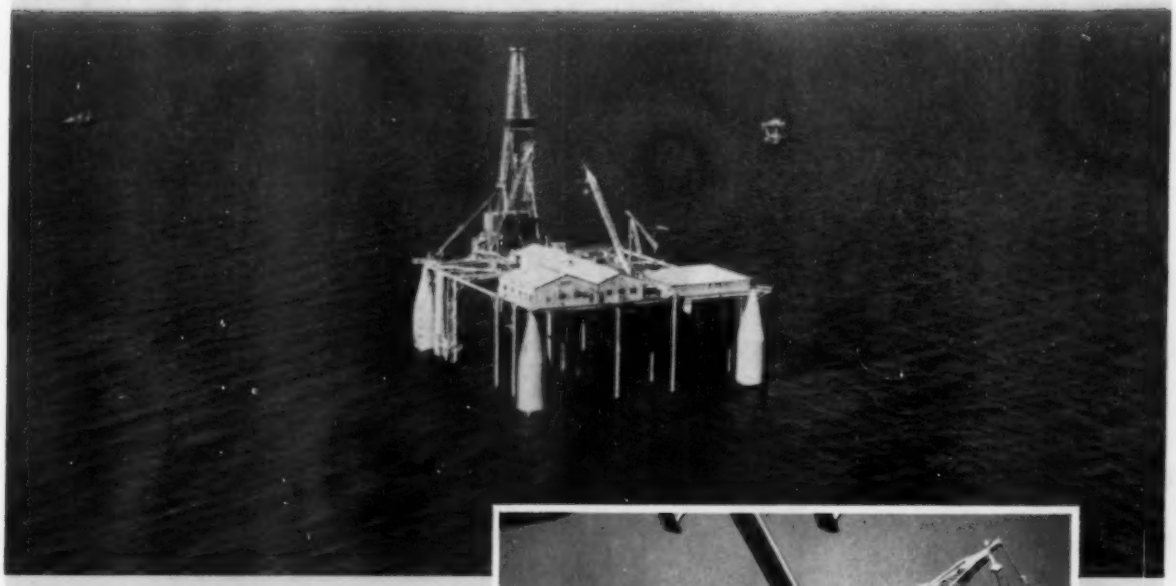
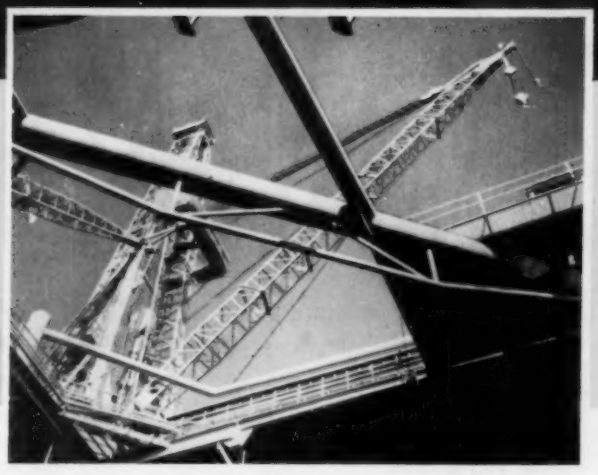
DIRECTIONAL DRILLING • FISHING & CUTTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE





Aboard the Blue Water No. 1...

Yellow Strand® is top choice!

The Blue Water No. 1, owned by the Blue Water Drilling Co., New Orleans, is one of the newest and most modern offshore drilling rigs. On this Gulf operation, Yellow Strand "POWERSTEEL"® Wire Rope was specified to assure fast, steady drilling! Its platform is 242′ long by 202′ wide, supported by giant caissons that are welded to a gridwork of 14′6″ pipe. The gridwork is the base of the rig, and rests on the floor of the ocean.

Business end of the rig is an Emsco double drum draw works, rigged up with 7500′ of Yellow Strand "POWERSTEEL" rotary line. A 2″ "POWERSTEEL" bridle is used to erect the derrick, and the sand line consists of 15,000′ of 9/16″ galvanized B & B. Two stiff legs are rigged up with Yellow Strand Wire Rope.

The men of Blue Water have plenty of reasons for preferring Yellow Strand—here are a few: Consistent quality, a size and type for every need, and good delivery and service from their Yellow Strand Distributor, Continental-Emsco Co.

Take advantage of this combination of quality wire rope and fast distributor service. Call your B & B Distributor today. Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Yellow Strand®

Wire Rope

ROUTINE or EMERGENCY

There's a WOODWARD SERVICE PLAN to meet your requirements

Woodward service assures proper installation of all the latest improvements. Our experienced personnel have at their disposal the very finest tools, testing equipment and special plant facilities to rebuild any Woodward governor in a minimum of time.

Very often, due to the addition of latest improvements, your rebuilt unit will outperform the same governor when it was new.
A new governor guarantee covers work done in our plants.

Here are four ways to have your governor put in "like new" condition.

1. REPAIR AND RETURN
While your engine is shut down for other work, send the governor to our Rockford, Illinois, plant. List the governor serial number on your purchase order and make sure your company name is on the crate. Give shipping instructions and be sure to tell us when you want it back.

2. GOVERNOR EXCHANGE
Tell us when you intend to make the installation. We'll ship a governor like yours but with all the latest improvements. You can quickly install the new unit. Send the old governor to us. The cost — round trip shipping plus time and material to overhaul your old governor for our exchange stock.

3. EMERGENCY SERVICE
For real emergencies we'll send a man to your plant, with a governor if necessary. Our fleet of airplanes is ready to rush men and material to cope with the situation. Rare but very real emergencies usually can be handled in one day or less.

4. YOUR OWN SERVICE
Some competent field mechanics, experienced in small parts assembly, repair their own governors in the field. Send us the serial number of the unit, tell us what it's controlling and inform us of any suspected deficiency. We'll send Instruction & Parts bulletins and suggest parts you may need.
If you have a number of governors, send your mechanic to our plant for two to four days training. Travel and living expenses are the only costs.

Similar services are available to our European customers at our Schiphol, Netherlands, facility.

WOODWARD GOVERNOR COMPANY

ROCKFORD, ILLINOIS

Fort Collins, Colorado — Schiphol, The Netherlands

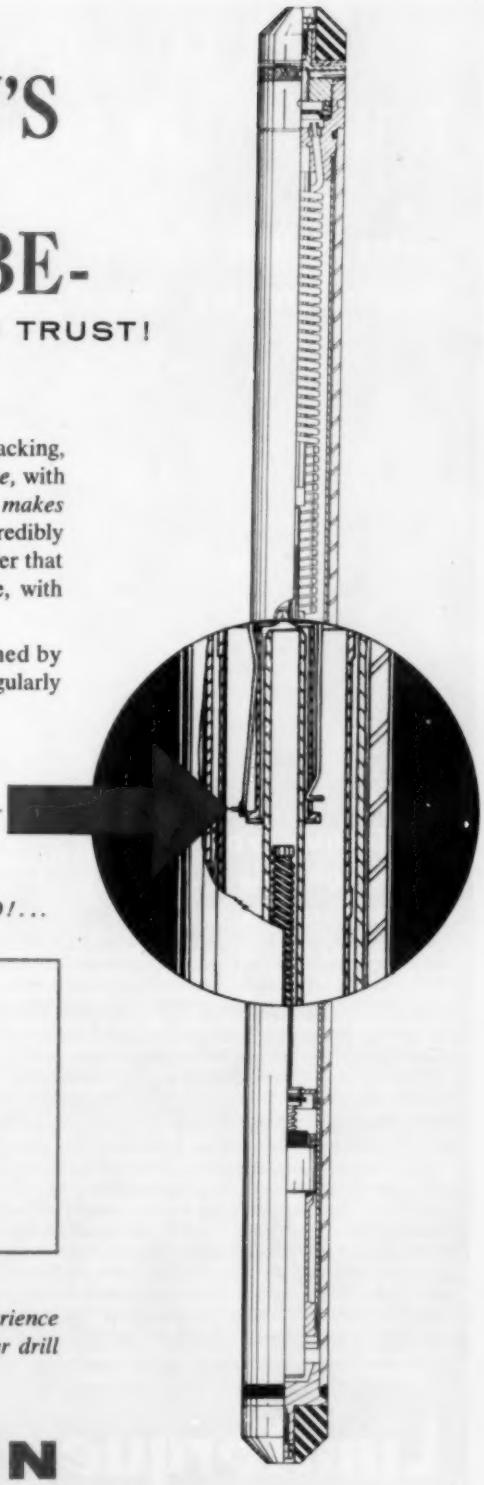
WORLD'S OLDEST AND LARGEST MANUFACTURER OF HYDRAULIC GOVERNORS EXCLUSIVELY

HALLIBURTON'S

friction-free

BOURDON TUBE-

FOR TESTING RESULTS YOU CAN TRUST!



Unlike some recording gauges that incorporate packing, the Halliburton Bourdon Tube is virtually *friction-free,* with only one point of pressure contact . . . *where the stylus makes its mark upon the chart.* There, the pressure is incredibly low, averaging but 6/100th of an ounce! It's no wonder that the Halliburton Bourdon Tube is extremely accurate, with a tolerance of only one-half of one per cent!

This unmatched accuracy is constantly maintained by Halliburton Testing Services; each Bourdon Tube is regularly calibrated bi-monthly.

. . . WHO READS THE CHART? . . . THAT'S IMPORTANT TOO! . . .

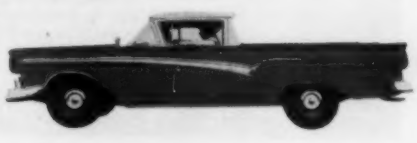
No matter how accurate, chart data is valueless unless properly interpreted. Halliburton Chart Readers are skilled specialists, thoroughly trained in the use of the Halliburton Microreader . . . for double assurance of precision accuracy and experienced interpretation.

Get the benefits of Halliburton accuracy and experience in your reservoir evaluation. Call Halliburton for your drill stem test!

HALLIBURTON

OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

TESTING SERVICES



HALLIBURTON RESERVOIR EVALUATION:
A NEW WAY TO SAY DRILL STEM TESTING

PRE-SET COMPENSATING SPRINGS ASSURE TIGHT VALVE SEAT...

where variable high line temperatures are encountered

specify LimiTorque type SA valve controls . . . with compensating springs

Correct seating of the valve is extremely important during automatic valve operation, especially where fluctuation of high line temperatures are encountered.

To assure an absolutely tight seat, the new LimiTorque Type SA Unit incorporates unique compensatory springs which, literally, "takes up" any amount of contraction or expansion caused by decreasing or rising line temperature.

These springs of Belleville Disc type vary in number for use in either parallel or series, within fixed limits, to provide the desired compensation. The result of continual improvement and development, the Type "SA" LimiTorque contains all the features of the famous Type SMA unit plus a simple indicator to show the amount of compensating spring compression. Available in Weatherproof and Explosion proof construction, these units can be mounted on any size valve in almost any position.

For more specific information and data write for Bulletin 4-57 on your business letterhead.

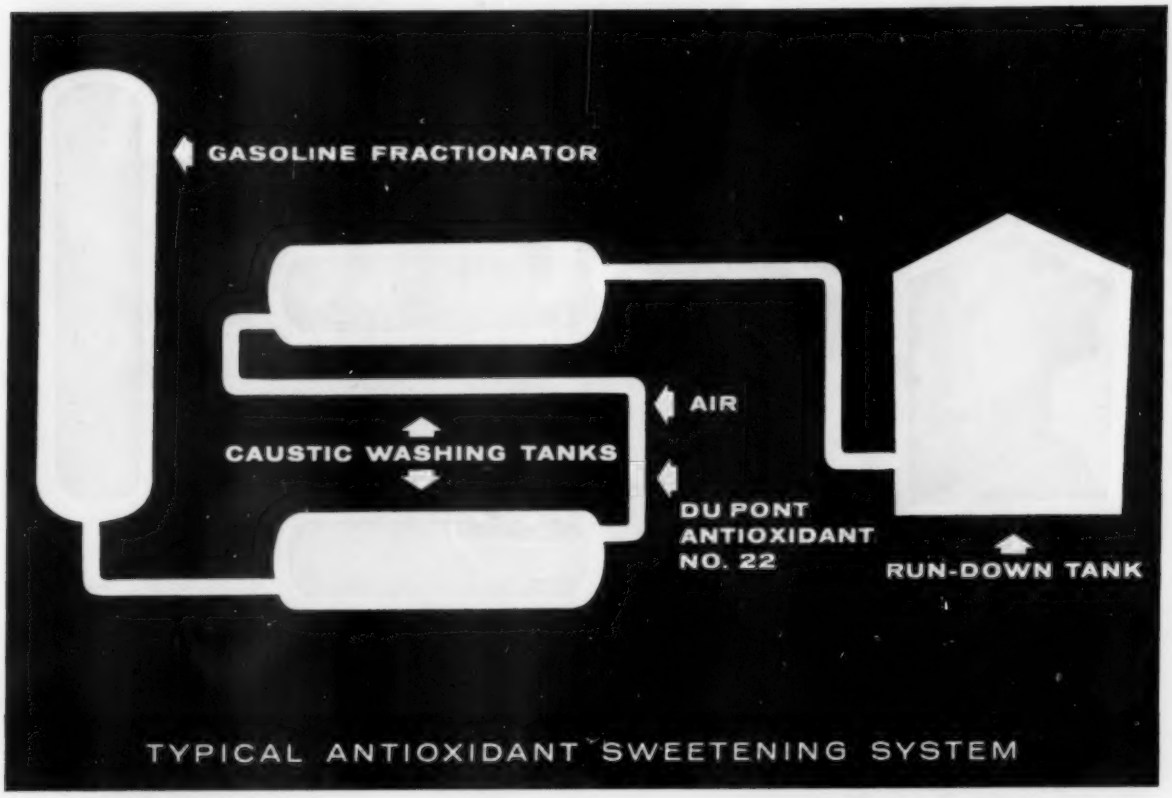
LimiTorque®

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia



Reduce treating costs...

sweeten with antioxidant 22

BY HAROLD J. SCHEULE

With one additive you can take two steps—important ones—in treating gasoline: stabilization *and* sweetening. Du Pont Antioxidant No. 22 (AO-22) is a sweetening agent as well as a stabilizer. And in a single, inexpensive operation both objectives can be attained.

The equipment for sweetening with antioxidants is much less expensive than other types of sweetening equipment. Or, if you prefer to continue using your present equipment, the cost of converting it will be extremely low. The advantage of low operating costs is available either way.

Another important advantage of sweetening with Du Pont AO-22 is that no undesirable chemicals such as sulfur or copper are added to the product. Therefore, the chance of contamination from these elements is eliminated. Also, there is no loss of gasoline or octane number when sweetening is done with AO-22.

Complete line

Since Du Pont supplies a complete line of gasoline antioxidants, our representatives are qualified to advise you on all types of gasoline stability problems.

In addition to Antioxidant No. 22 (N, N'-di-secondary-butyl para-phenylenediamine), the Du Pont line includes gasoline Antioxidants No. 5 (50% N-normal butyl-para-aminophenol) and No. 29 (2,6-di-tertiary butyl-4-methylphenol).

THIS BOOK contains detailed information about all three Antioxidants. Ask any Du Pont Petroleum Chemicals representative for a copy, or write us. E. I. du Pont de Nemours & Co. (Inc.), Room 2420-15 Nemours Building, Wilmington 98, Delaware.

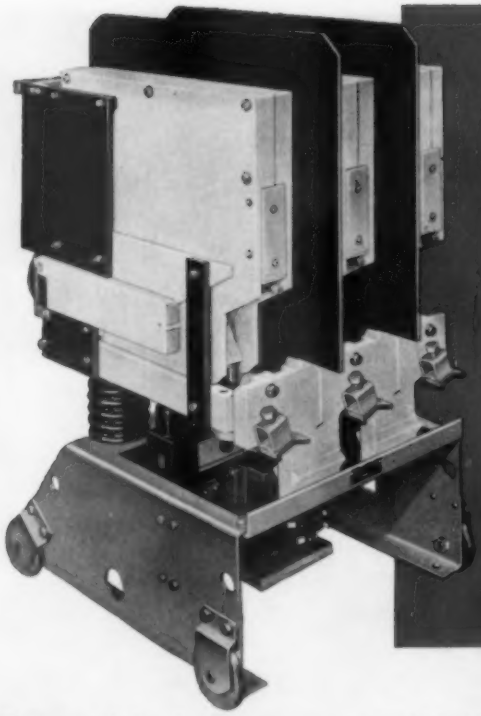
HAROLD J. SCHEULE has for three years been supervisor of the gasoline group. This is part of the Product Application and Service Division of our main Petroleum Laboratory, Carney's Point, N. J.

See the "DU PONT SHOW OF THE MONTH" on CBS

DU PONT

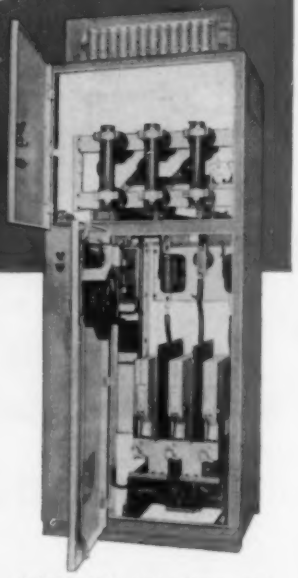
Better Things for Better Living
. . . *through Chemistry*

Tetraethyl Lead
and other
Petroleum Additives



Air break starters
for high voltage motors

A-B QUALITY



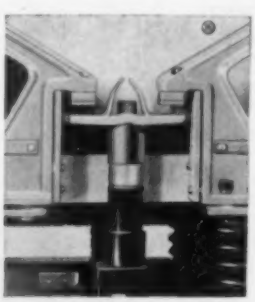
This *new* air break contactor—around which Allen-Bradley has developed a complete line of high voltage starters—is designed to match your *toughest* applications. It features the same solenoid design—with only *one* moving part—that has made Allen-Bradley low voltage starters universally recognized for their tremendous operating life.

These new contactors are available in full voltage and reduced voltage starters—nonreversing or reversing—for squirrel cage, part winding, slip ring, and synchronous motors up to 1500 hp, 2300 volts; 2500 hp, 4600 volts. All starters are equipped with current limiting fuses and have an interrupting capacity of 150,000 kva at 2300 volts and 250,000 kva at 4600 volts.

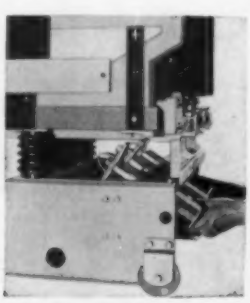
It will pay you to investigate these *quality* starters. Complete information is contained in Publication 6080 . . . please send for your copy, today.

Bulletin 966 high voltage air break, across-the-line synchronous motor starter in NEMA Type 1 enclosure.

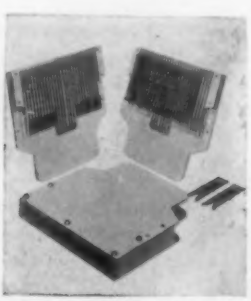
Only One Moving Part. Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.



Double Break Contacts of silver alloy never need maintenance. Vertical motion assures uniform contact pressures.



Easy Access from Front. Crossbar and contacts removable from front, without special tools, for easy inspection.

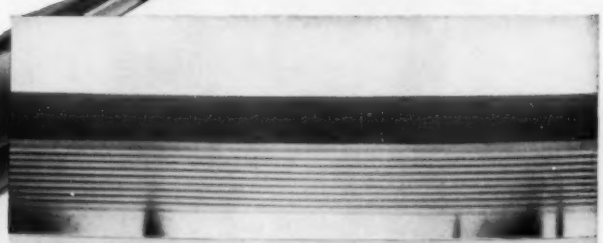


Faster Arc Suppression. New blowout design and novel arc chute. Chutes are molded from an arc resistant material.

Allen-Bradley Co.
1304 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ontario

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Pedrick chrome rings are Pre-Seated!



Bright highlight along lower face of ring shows pre-seated area from factory lapping.

You have no long break-in period with PEDRICK Chrome Rings. Almost immediately you get the full benefits of the Chrome surface which is practically scuffless, which withstands high temperatures, abrasion and corrosion, and which increases ring life up to four times.

This is so because PEDRICK laps or pre-seats its Chrome rings to cylinder size at the factory. This reduces break-in time up to 80% and enables the engine to be put under full load very quickly, with all the benefits of Chrome. Furthermore, PEDRICK Chrome rings are the most-modern twist-seal or taper-face designs, which in themselves speed seating and assure a quick, positive seal.

So, for the very best in quality, the very latest in engineering design, make your rings PEDRICK. Let our engineers cooperate with you on special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Penna., SAratoga 9-3770.

Pedrick PISTON RINGS

PEDRICK PIONEERED *Conformable* PISTON RINGS FOR BIG-BORE ENGINES

Welex YELLOW Has Gone to Sea

In the area which had been set aside for sea gulls and ships and sharks, the tremendous offshore drilling platforms have become a recognized partner. Now, the Welex offshore units have added their yellow brilliance to this picture. Here, oil men have tapped resources that are thousands of feet underneath a land that is covered by hundreds of feet of water. To aid these sea-going oil men, Welex offshore units offer the same top flight services that have earned the confidence of operators and producers on land for many years. From these bright yellow offshore units, perforating, resistivity and radioactivity logging and other special wireline services of unexcelled quality are all in a day's work. Only with Welex on the job can operators be assured of having available *every* needed logging and perforating service. On land or offshore, Welex offers the most complete industry-accepted wireline services whenever and wherever they are needed.

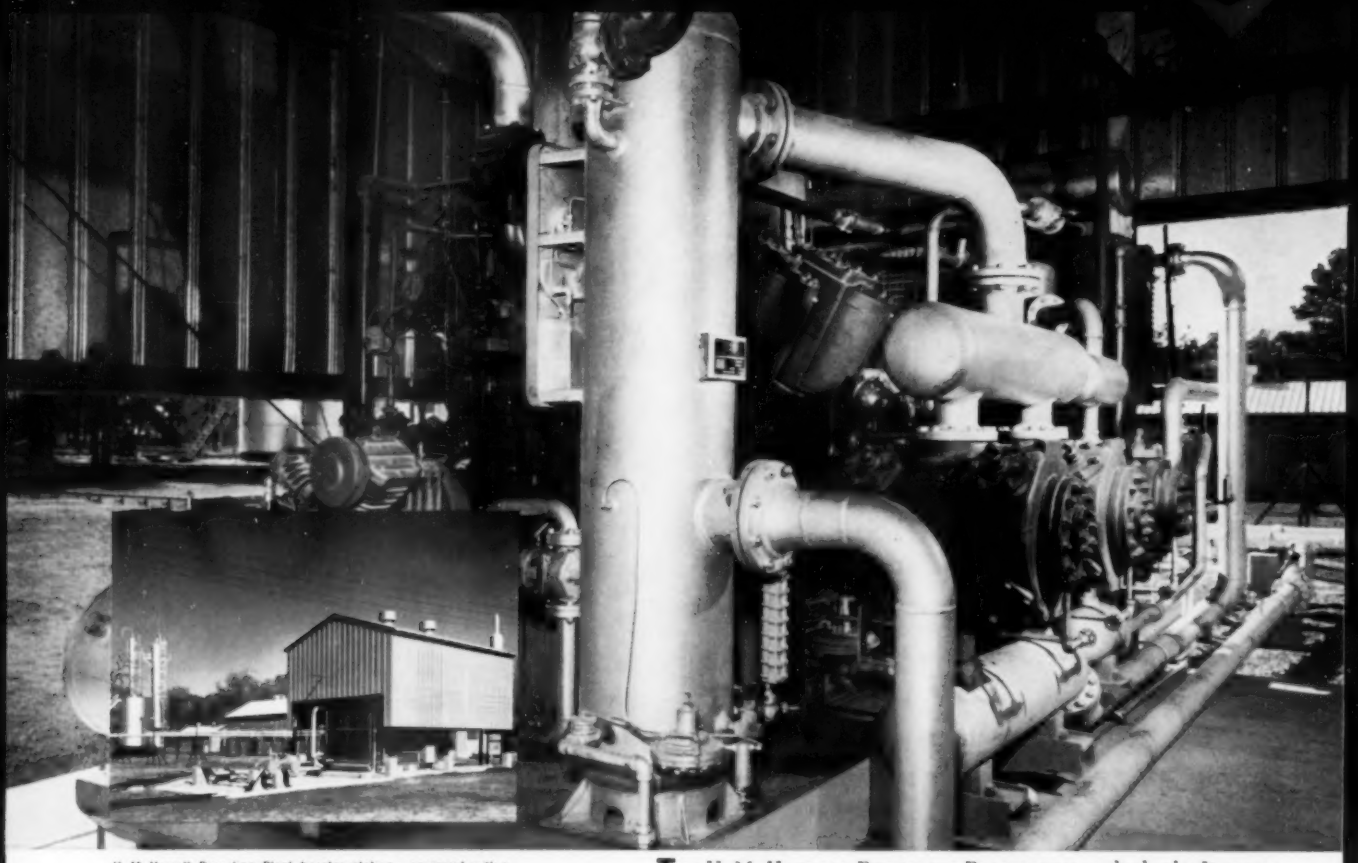
ORIGINATORS OF JET PERFORATING
Welex

WELEX, INC.

Fort Worth, Texas

Division offices in Dallas, Denver, Houston, Los Angeles, Midland, New Orleans, Tulsa and Wichita • Subsidiaries in Canada, Peru and Venezuela

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant



H. M. Harrell Recycling Plant booster station -- equipped with a Beaird - Ingersoll - Rand 6SVG 330 h.p. four cycle gas engine driven packaged compressor plant. Young radiator with lubrication oil cooler and gas coolers, and all necessary controls for unattended operation. Other sizes 120 to 660 h.p.

At Large Recycling Plant–

PACKAGED COMPRESSOR CONSERVES 2,000,000 CFD. IN LOW PRESSURE GAS

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

LOWEST COST PER HORSEPOWER INSTALLED

THE H. M. HARRELL RECYCLING PLANT serves a dual role. It represures wells in the Bammel Field and injects gas into formation storage for a large Texas utility. Designed to operate with 400 psig. suction, the original plant was unable to pick up 2 mmcfd. in low pressure gas produced by five nearby wells. This gas has now been added to the plant through the installation of a Beaird-Ingersoll-Rand 6SVG 330 h.p. packaged compressor.

Picking up from the wells at 20 to 25 psig. the Beaird unit boosts the gas through two stages delivering it to the plant compressors at 450 psig. Critical input gas temperatures at plant compressors were met by equipping the packaged compressor radiator with gas interstage and after cooling sections.

The packaged compressor has been designed for unattended operation. Its driving engine is equipped with a regulator which enables the speed to vary from half to full throttle, controlled by the suction pressure. Discharge pressures remain constant. Other controls and shutdown devices protect unit from unforeseen operating conditions.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor can be designed to meet your special requirements.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

A Subsidiary of American Machine & Foundry Company

SHREVEPORT, LOUISIANA • *Sales Offices: Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado Los Angeles, California, and Cie. Ingersoll-Rand, Paris, France.*

BEAIRD INTERNATIONAL, INC.
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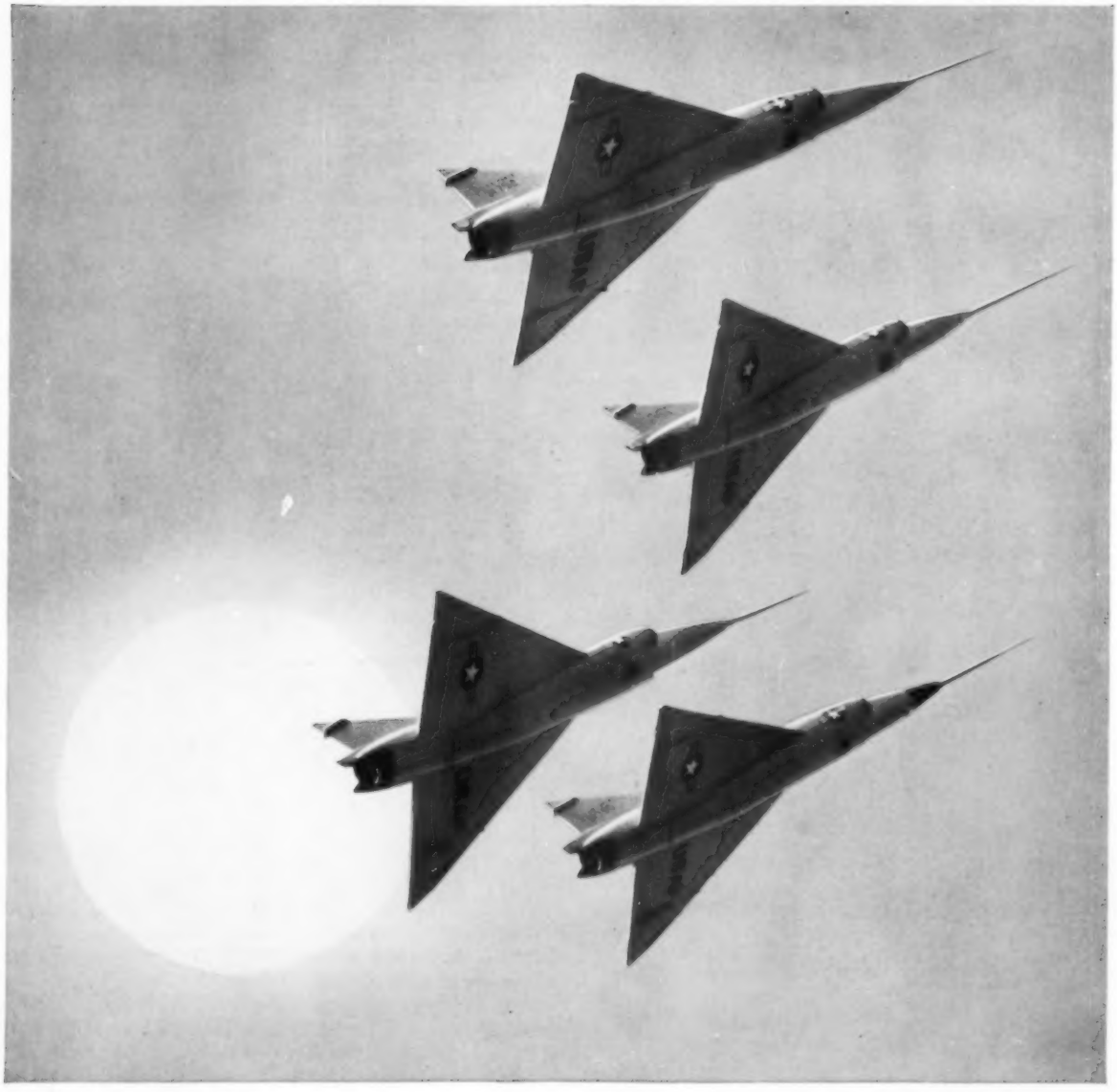


PLANES THAT OUTRACE THE SUN...

Like Joshua, America's newest jets make the sun stand still . . . fly at speeds that "set back the clock" . . . "arrive before they start."

But such success breeds ever greater problems. For example, fuels and lubricants are whisked from tropic heat to frigid stratosphere. Fiery jets and sensitive controls demand far different lubricants. That's why years ago Texaco built the largest privately-financed jet fuel testing laboratory in America.

Texaco's forward-looking research meets every challenge to maintain the finest in petroleum products.

THE TEXAS COMPANY

TEXACO

progress . . . at your service

STOP RUST!

with

RUST-OLEUM®

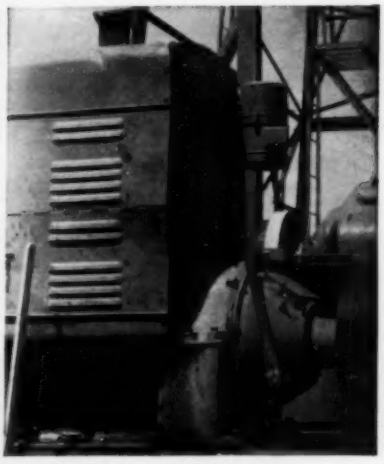
and match original equipment

COLORS

Resists Salt Air, Salt Water, Sun, Heat, Fumes, Blowing Dust and Sand—Yet Dries Quickly and Hard to a High Gloss Finish!

Do the job right in the field—right over the sound rusted surface! Just scrape and wirebrush to remove rust scale and loose rust — then brush or spray Rust-Oleum 769 Damp-Proof Red Primer (or H-50 Primer) over the remaining rust. Then—follow-up with the Rust-Oleum finish coat to match the original manufacturer's colors. That's all there is to it. Applied over rust—Rust-Oleum keeps your equipment looking better . . . LONGER!

Rust-Oleum is *exclusive,* incorporating a specially-processed fish oil base that penetrates rust to bare metal. It dries right, is free of objectionable odor, is ready-mixed and self-leveling. Specify genuine Rust-Oleum. Accept no substitutes. Many leading industrial oil field supply distributors carry complete stocks for your convenience.



FOR FREE TEST SAMPLE—ATTACH TO YOUR LETTERHEAD AND MAIL TO: RUST-OLEUM CORPORATION 2623 OAKTON ST., EVANSTON, ILL.

Please Send Me a FREE TEST SAMPLE to Match the Following Color: (check sample desired)

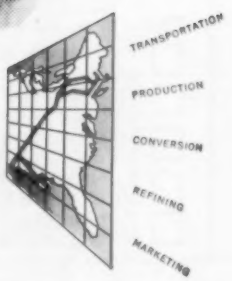
- ☐ Test Sample of 769 Primer to be applied directly over rusted surface
- ☐ Test Sample of CATERPILLAR YELLOW
- ☐ Test Sample of NEW NATIONAL BLUE
- ☐ Test Sample of NEW UNIT RIG GRAY
- ☐ Test Sample of NEW EMSCO GREEN
- ☐ Test Sample of BETHLEHEM YELLOW
- ☐ Test Sample of WAUKESHA GRAY
- ☐ Test Sample of OIL WELL ORANGE
- ☐ Test Sample of OLD EMSCO GREEN
- ☐ Test Sample of READY-MIXED ALUMINUM
- ☐ Test Sample of HIGH GLOSS WHITE
- ☐ Test Sample of QUICK DRYING BLACK
- ☐ Nearest Source of Supply
- ☐ Complete Literature and Color Charts.

Great industries are born of great ideas . . .

Natural gas, for example, was once an oddity of nature. Harnessed by the pipeline it has become one of America's key industries.

Tennessee Gas, the nation's longest pipeline, transports about two billion cubic feet of natural gas daily. It also explores for and produces gas and oil, extracts and converts their hydrocarbons, refines and markets the products of petroleum.

Today, we're active in every phase of the industry. Better equipped than ever to supply the heat, power, raw materials vital to our expanding economy.



TENNESSEE GAS TRANSMISSION COMPANY

AMERICA'S LEADING TRANSPORTER OF NATURAL GAS

HOUSTON, TEXAS

Now, lay coated pipe without "Special" handling

ABOVE: 16-inch pipe being spray-coated for use in new Transcontinental Gas Pipe Line Corp. gas-gathering system near Tilden, Texas.

Save up to 20 per cent in laying costs on large-diameter pipelines. Spray—coat pipe with Copon Arocoat before installation. Then, haul it, stack it, bend it and lay it with little more care than you would use for bare pipe. Tough Copon Arocoat coatings will survive these operations without chipping or cracking, and Copon Arocoat can be applied to welds with an ordinary paint brush.

A combination of epoxy and coal tar resins, Copon Arocoat coatings provide superior corrosion control. They will not deteriorate in the ground . . . remain tough and elastic . . . and are unaffected by temperature extremes. Successful applications include submerged, buried and exposed transmission lines.

Get complete information on Copon Arocoat, industry's newest weapon in the fight against rising costs of corrosion. Write today to the Copon Associate located nearest to your city.

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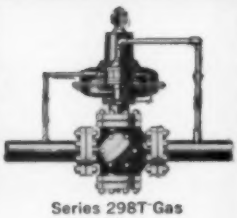
Type 630 "Big Joe" Field Regulator

Series 99-I Multi-Purpose Gas Regulators



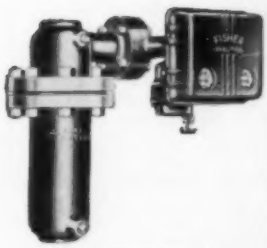
Series 298T Gas Regulators

Type 655-A Pressure Regulator

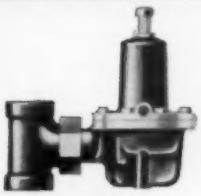
IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

"Supermarket"

give 36 hour Factory service!



Series 2500-249 and
2500-259B
Level-trols
Cage Sizes 14" and 32"



Series 620 and 621
Farm Tap Regulators

Series 67FR Combination Filter Regulator

Yes, now you can shop by phone, wire or TWX (Marshalltown 578 or 579) and expect shipment of the equipment illustrated at left in a matter of hours. Now that Fisher Control Valves and Regulators are as readily available as your supermarket groceries, you can meet your emergency needs quickly. Fisher carries a stock of the popular and standard size control valves, displacement type liquid level controllers, pressure regulators and gas regulators on the "supermarket" shelf at all times. The offices in red maintain a wide selection of Fisher equipment in their own inventory.

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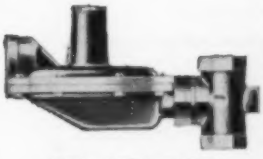
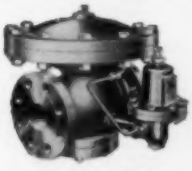
Now, for emergency needs contact either the Fisher representative or the Fisher home office. Your order will be en route within 36 hours (except Saturday and Sunday) after it is received in Marshalltown.



Series S100 and 730
Service Regulators



Type 92B Pilot
Operated Steam
Reducing Valve

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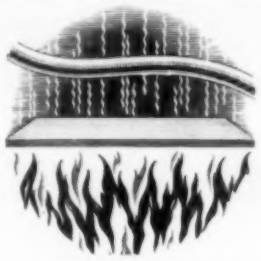
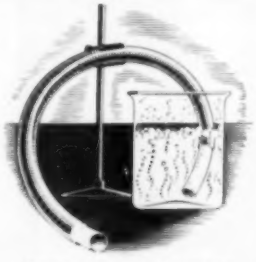
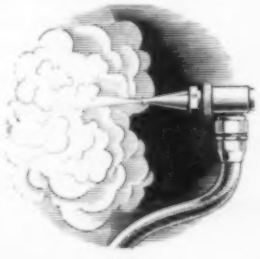
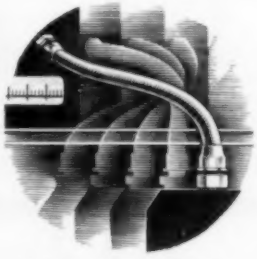
HOSE LINES
must cope with
these conditions...


HIGH TEMPERATURES


CORROSIVE CHEMICALS

ADHESIVES


LIVE STEAM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HIGH PRESSURES

you can cut costs, increase reliability with hose made of
TEFLON® TFE-fluorocarbon resins

Hose lined with TEFLON TFE-fluorocarbon resin is being specified for the toughest jobs, *because:* TFE resins are unaffected by practically all corrosive chemicals and solvents. They can take continuous operating temperatures up to 500°F. . . . remain tough and flexible in extreme cold. They have excellent endurance under severe conditions of impulsing and vibration. Handle live steam without failure. Repel adhesion of sticky or viscous substances . . . reduce possibility of contamination. Available with either permanent or reusable couplings.

Discover how hose lined with TFE-fluorocarbon resin can cut your maintenance and downtime losses. See your hose supplier or write to: E. I. du Pont de Nemours & Co. (Inc.), Room 2420, Nemours Building, Wilmington 98, Delaware.

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TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed here.

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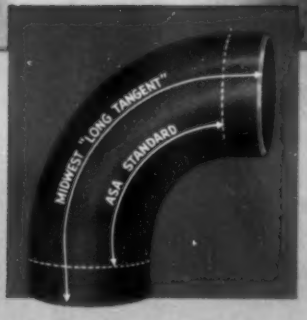
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

A familiar sight around gas pumping stations

One of six new semi-automatic gathering stations of the Northern Natural Gas Company that have Midwest "Long Tangent" Elbows ... and other Midwest Welding Fittings.

MIDWEST "LONG TANGENT" ELBOWS

Midwest "Long Tangent" Welding Elbows are "a natural"... their many benefits for the user are today so generally recognized that you see them wherever you go. For all the facts, ask your Midwest Welding Fittings Distributor (or write us) for a copy of Catalog 54.



ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- They save pipe.
- They often eliminate short nipples and their extra welds.
- They save time and money in lining up and clamping pipe and fitting.
- They make it easier to apply slip-on flanges.
- They remove the circumferential weld from point of maximum stress and can be sleeved.
- THEY COST NO MORE THAN OTHER ELBOWS.

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MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

20 more
WESTERN GEAR
High Speed Drives
push vital natural gas 845 miles — from the Gulf to the West Virginia border!

Twenty additional two-stage Western Gear high speed units are now being delivered to Gulf-Interstate Gas Company for the expansion of its 845 mile, 30 inch main pipeline to increase its capacity to 575 million cubic feet daily. The outstanding success of its first remote controlled satellite station at Stanton, Ky., has attracted the attention of the industry to this significant Gulf-Interstate development. Western Gear engineers were called upon to design a two-stage high speed gear drive to step up the 5000 H.P. natural gas operated 16 cylinder Cooper-Bessemer engine to power a centrifugal compressor at 6,055 RPM. Western Gear salutes Gulf-Interstate for its achievement and stands ready to assist other forward-looking companies in solving their mechanical drive problems. Experience gained since 1888 assures efficient and reliable performance of Western Gear designed equipment. For assistance write Western Gear Corporation, General Offices, P.O. Box 182, Lynwood, California.

"The difference is reliability" • Since 1888

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WESTERN GEAR Corporation
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PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.)
SEATTLE AND HOUSTON—REPRESENTATIVES IN PRINCIPAL CITIES

CLIP AND SAVE

NEW

...and Sure to Win Their Way to the Heart of Industry

Many optional features, including built-in power steering, add to the versatility of the "440" Wheel-Type.

Ruggedness, power, operator's comfort, and all-around economy are featured in the new "440" Crawler.

JOHN DEERE "440" Industrial Tractors

NEW Styling Throughout . . .

NEW Long-Life Construction . . .

NEW Operator Comfort, Convenience, and Protection . . .

NEW Operating Advantages . . .

NEW Ease of Adjusting and Servicing . . . All-Around Economy.

Worthy "Stablemate" of the Popular "420"

Every inch another "thoroughbred," the new John Deere "440" is a worthy "stablemate" of the ever popular John Deere "420," the busy, capable, and economical crawler that continues to merit the praises of efficiency-minded industrial users everywhere.

With a capacity for work that must be seen to be believed, combined with a nimbleness that cuts maneuvering time drastically, they have the ability to squeeze more work out of every piece of equipment and to press more work into every hour.

HERE they are . . . trim and eager . . . and literally "born" to save you money, whatever business you're in—the New John Deere Industrial Tractors.

"Born" to save you money?

We could hardly put it better. For these are INDUSTRIAL tractors from top to bottom . . . ruggedly built from grille to drawbar . . . and designed, inside and out, to fill definite needs in industrial work of all types . . . to cut to rock bottom the costs of such jobs as earth moving, materials-handling, sand and gravel work, mowing, maintenance, and many other—often specialized—jobs in contracting, construction, utilities, manufacturing, and public works.

Both tractors are built around an amazingly efficient John Deere engine, unmatched for delivering so much, for so long, for so little cost. Both have many construction features of hood, grille, frame, and either wheel or track assemblies—plus optional new clutch-type direction reverser—that enable them to do more than their share of the day's work of pushing, pulling, lifting, digging, and hauling. Their clean, modern, functional design throughout makes them businesslike in operation, easy to service and economical to maintain. A line of proved, matched working equipment gives them the versatility that industry demands.

Size up these modern tractors in the light of your requirements. It may be the start of making your power dollars go farther than you thought possible.

JOHN DEERE Industrial

Completely Engineered for Industry

For Further Information Write: JOHN DEERE INDUSTRIAL DIVISION · MOLINE, ILLINOIS

Here's Refrigeration Designed For Every Basic Oilfield Application!

...It's The New BS&B "COLD-FRAC*" Ammonia Absorption Refrigeration Unit

With the development of BS&B's new "COLD-FRAC" AMMONIA ABSORPTION REFRIGERATION Unit, the oil industry now has a simple, non-mechanical, heavy duty artificial refrigeration system which is applicable to any oilfield or refining process requiring temperatures below ordinary atmospheric level.

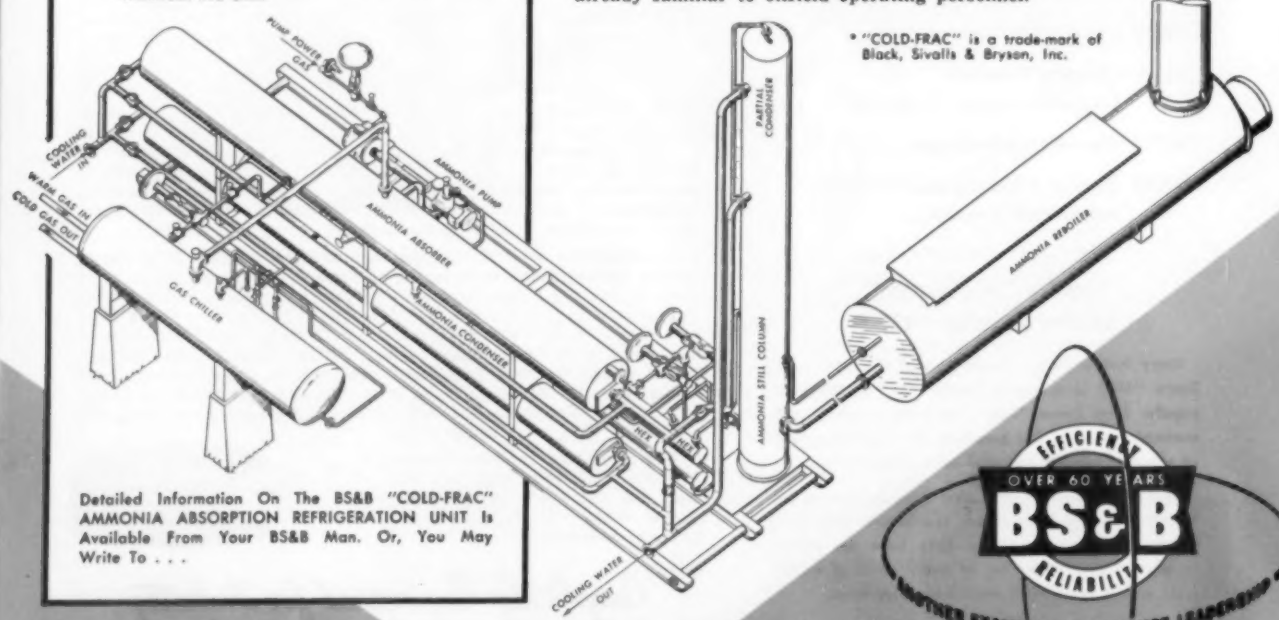
A few examples of immediate industry applications are:

1. **Gas Pipeline Companies — For The Elimination Of Liquids In Gas Transmission Lines Through Better Hydrocarbon Dewpoint Control.**
2. **Gasoline Plants — For The Chilling Of Absorption Oil To Increase Hydrocarbon Recoveries Without Installing Larger Absorption Oil Towers Or Pumps.**
3. **Lease Production — To Provide Essential Refrigeration For Maximum Hydrocarbon Recovery Where Sufficient Pressure Expansion Is Not Available. Also To Supplement Declining "Natural" Refrigeration.**

These Ammonia Absorption Refrigeration Units are built for rugged, heavy duty, 365 day-per-year continuous operation, and are available in eleven standard sizes. Completely automatic in operation, they are equipped with BS&B oilfield-type controls and motor valves which are already familiar to oilfield operating personnel.

OUTSTANDING FEATURES:

1. **Entirely Self-Operating.** Automatically Adjusts to Load Changes.
2. **Low Initial Cost.** Unit May Be Skid-Mounted Except Ammonia Reboiler. Outside Construction — No Buildings Required.
3. **Low Cost Maintenance.** Liquid Pump Is The Only Moving Part.
4. **Operating Costs Vary.** In Direct Proportion To The Load.
5. **Lower Operating Temperatures** Do Not Materially Decrease Capacity.
6. **Completely Closed System.**
7. **Chiller "Slop Over" Of Liquid Refrigerant Causes No Problem.** (There is no compressor to cause worry about liquids in the suction.)
8. **Oil Lubrication Eliminated.** No Oil-Refrigerant Problem.
9. **Vibration Free.** No High Speed Reciprocating Machinery To Mount.
10. **Experts Are Not Required** To Operate and Maintain The Unit.



* "COLD-FRAC" is a trade-mark of Black, Sivalls & Bryson, Inc.

Detailed Information On The BS&B "COLD-FRAC" AMMONIA ABSORPTION REFRIGERATION UNIT Is Available From Your BS&B Man. Or, You May Write To . . .

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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Guardian of pipeline performance

Everywhere

W-K-M Through-Conduit Gate Valves provide reliable, positive fluid control on pipelines the world over under all conditions of service. Consult W-K-M fluid control specialists when you plan your next pipeline.

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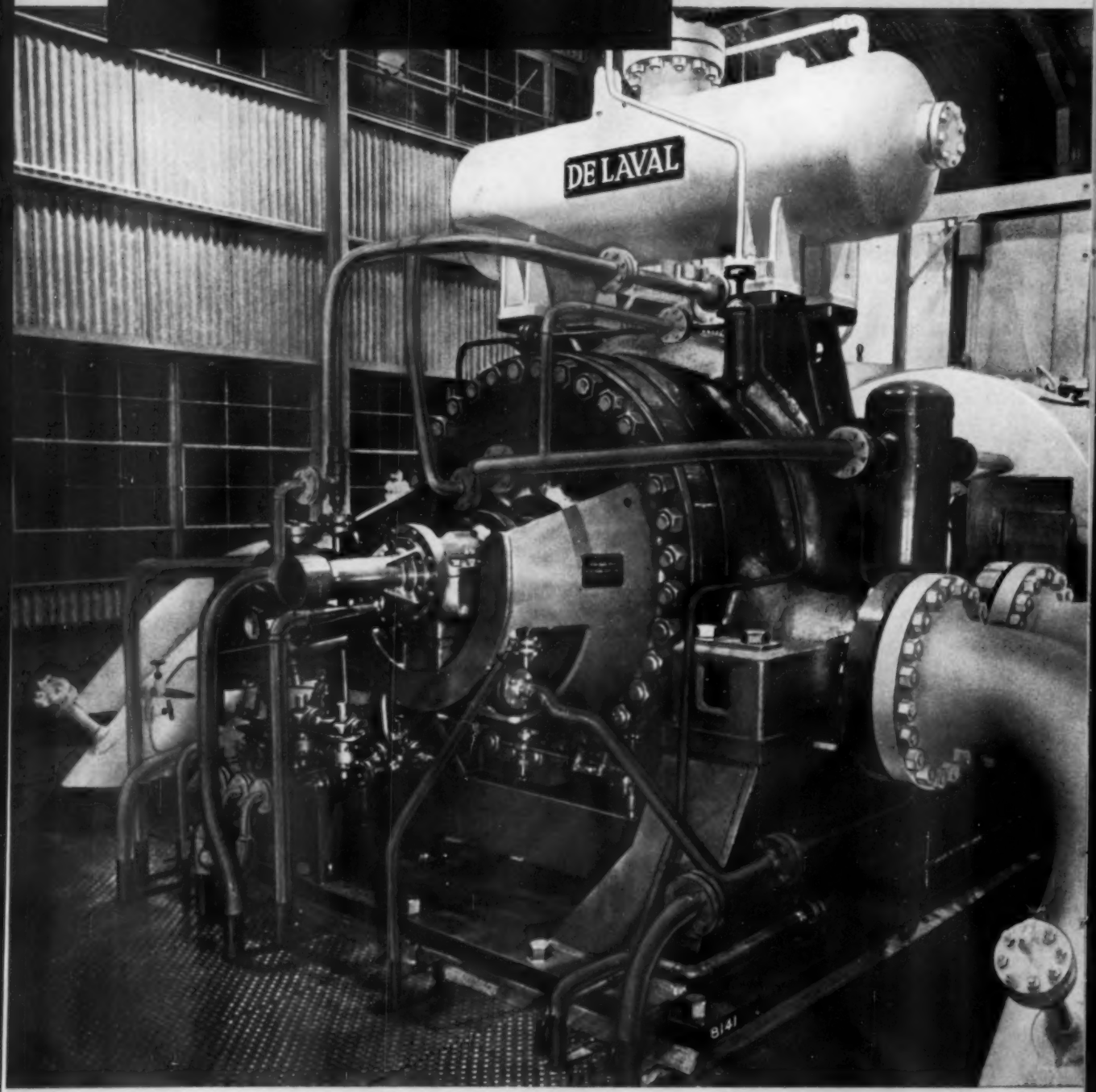
MANUFACTURERS OF W-K-M GATE VALVES acf LUBRICATED PLUG VALVES KEY-KAST ALLOY STEEL PIPING FITTINGS KEY RETURN BENDS AND FITTINGS

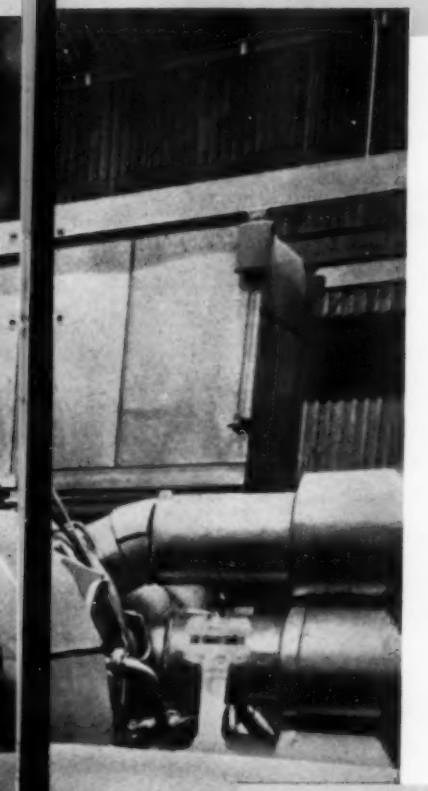
DE LAVAL
Series-Parallel
CENTRIFUGAL COMPRESSORS

provide extra



This De Laval Series-Parallel 6,350 hp centrifugal compressor is giving round-the-clock service in the Edna Station of the Trunkline Gas Company. Two other identical De Laval S-P units are doing a dependable job in the Kountze and Premont, Texas stations of this natural gas transmission system.

flexibility for Trunkline Gas Company

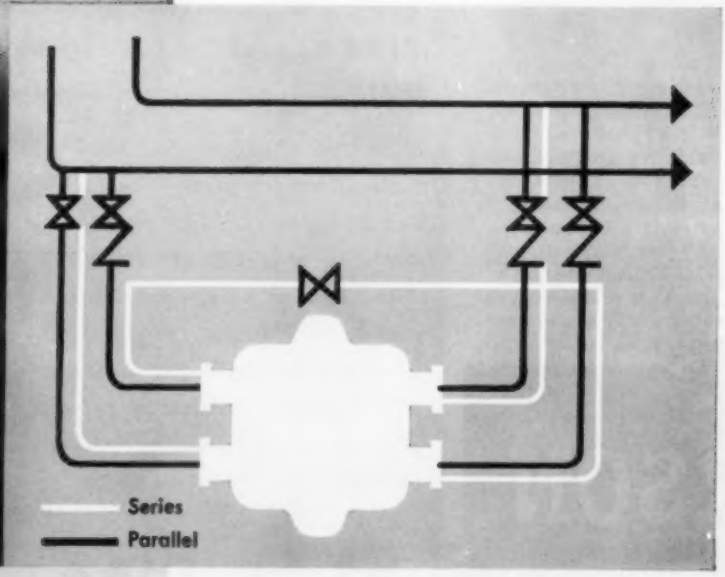


Booster station service demands flexibility in pipeline compressor design, which is available to a considerable degree in the standard De Laval single stage pipeline compressor. Some applications, however, require an exceptionally wide range, and the De Laval Series-Parallel centrifugal compressor has been designed to meet that need.

A good example is the De Laval Series-Parallel 6,350 hp compressor, shown in the photograph at left. It is one of three identical units serving booster stations of the Trunkline Gas Company.

S-P compressors are multi-stage units with the impellers arranged in two groups. Two inlet nozzles permit operating the impeller groups in series or in parallel as shown in the flow diagram. Within the horsepower limits of the driver, the compressor can be transformed from a high-flow, low-head machine to a low-flow, high-head unit *simply by operation of the external valving*. No changing of parts, not even a shutdown is necessary.

The reliability and economy of De Laval centrifugal compressors have been proved in natural gas transmission service throughout the country. You will find it pays to look to De Laval . . . the company that has specialized in the development of these units. De Laval pipeline compressors are operating in sizes from 2500–15,000 hp and with all types of drivers—gas turbines, gas engines, steam turbines and electric motors.



For additional information, write for the article "Tailoring Centrifugal Compressors for Pipe Lines" as well as De Laval Bulletin 503.

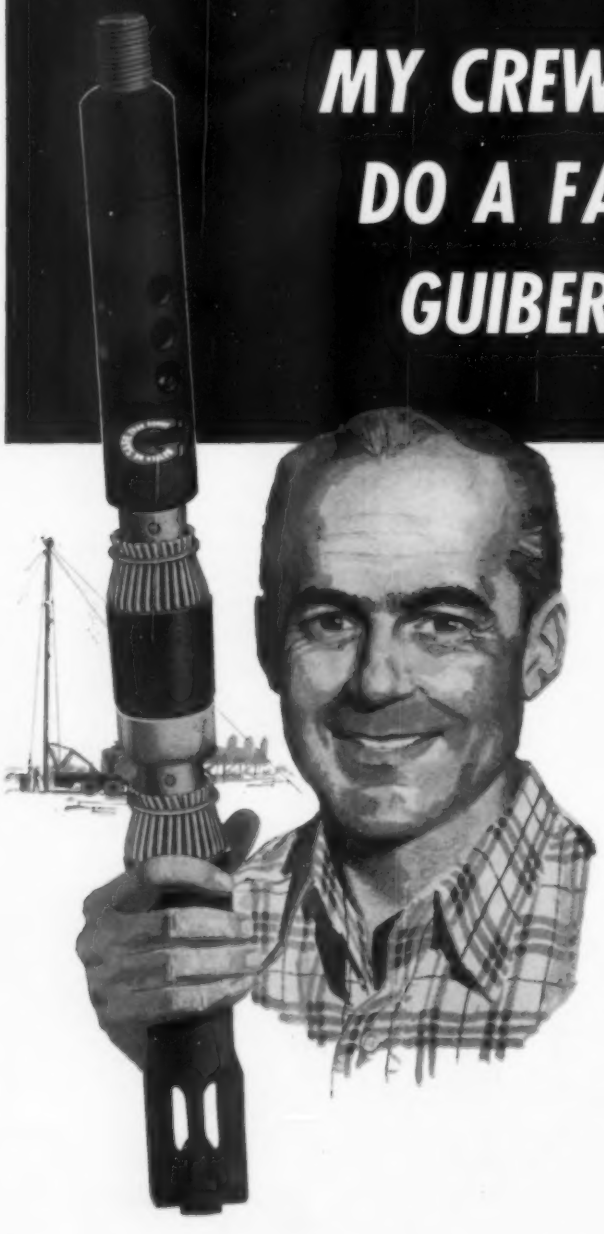
DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY

810 Nottingham Way, Trenton 2, New Jersey

04399

MY CREWS DO A FASTER JOB with GUIBERSON SWABS



There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

TYPE J .. lifts heaviest loads
TYPE L .. lifts medium or light loads
TYPE GW .. for light loads
TYPE K .. general purpose cup to 6,000 feet
SIMPLEX .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

Cups are compounded to Guiberson's exclusive formulas for maximum resistance to oil .. acid .. abrasion.

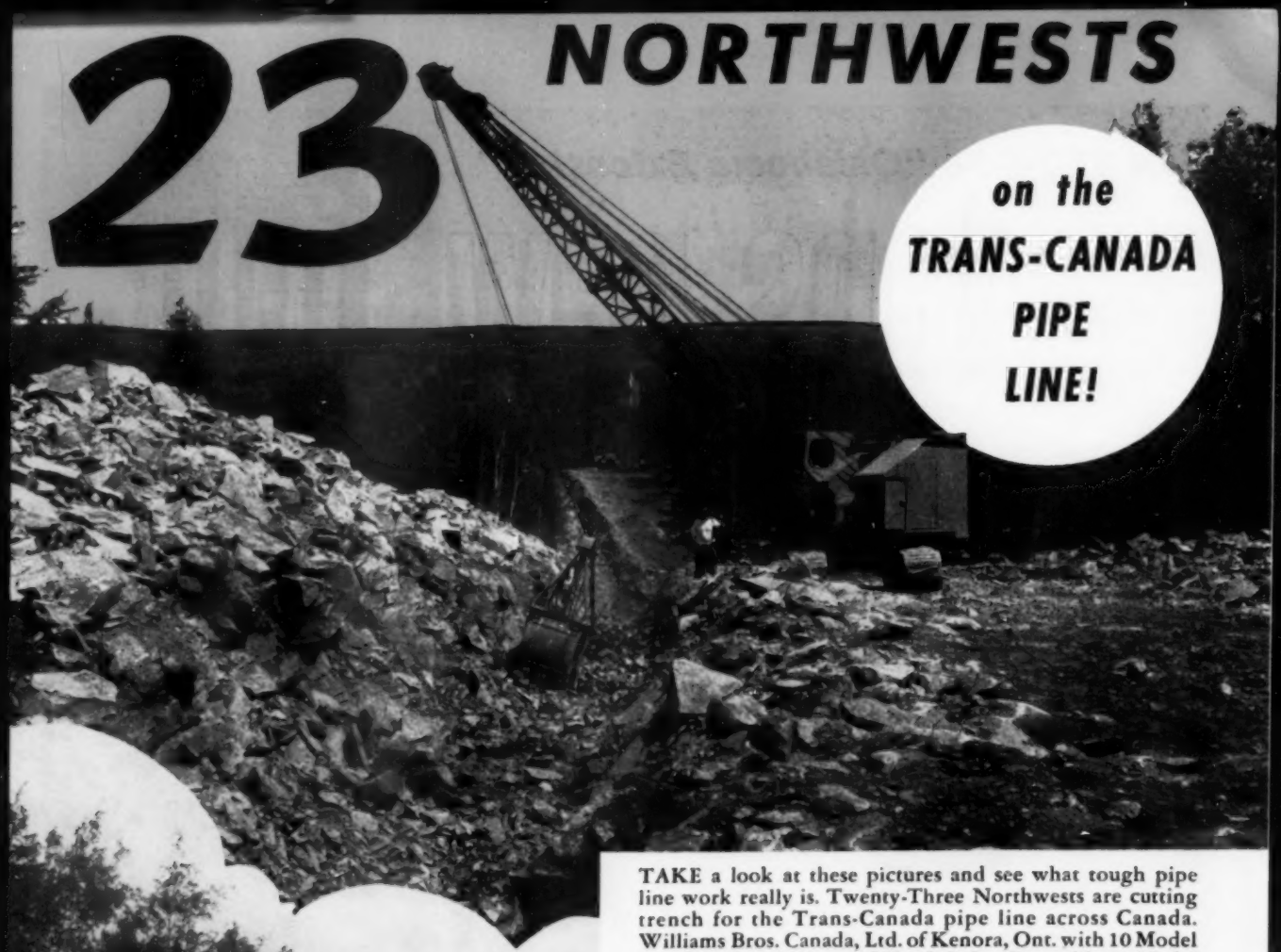
THE
GUIBERSON
CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by
Oil Field Supply Stores
Everywhere

23 NORTHWESTS

on the TRANS-CANADA PIPE LINE!



TAKE a look at these pictures and see what tough pipe line work really is. Twenty-Three Northwests are cutting trench for the Trans-Canada pipe line across Canada. Williams Bros. Canada, Ltd. of Kenora, Ont. with 10 Model 25's, Morrison-Shivers of Hawk Lake, Ont. with 11 Model 25's and Houston Contracting Co. with 2 Model 41's are overcoming the problems of tough rock, tricky river crossings and dense bush.

Northwests are workhorses. You can put them in the toughest work and know you are going to get real output from them. Northwest versatility—its ability to go places and do things a little more smoothly, a little faster, make it a cost cutter and time saver in any digging. It meets rock digging problems with greater output and it makes easy digging easier.

A wide range of boom hoist equipment gives you the right equipment for any hoisting job. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging. The "Feather-Touch" Clutch Control gives ease of operation with the *feel of the load* and without resorting to pumps, compressors, or other delicate mechanisms. These are just a few of the many design and operating features that have made Northwest the repeat order machine on pipe line work.

Let a Northwest man tell you more about them. Ask for a catalog on the size machine you need.

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1513 Field Bldg., 135 South LaSalle Street
Chicago 3, Illinois

NORTHWEST

Always Ready to GO

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

564-1C

New 350-mile "Oklahoma Extension"

taps new field...

A. O. Smith furnished 262 miles of the 26-inch pipe. Photo above shows some of the difficult conditions encountered in putting in the line.

Natural Gas Pipeline Company of America puts line into service in late November of '57

This new line (mainly 26-inch pipe) allows Natural Gas Pipeline to augment existing supplies from their fields in the Texas Panhandle. With the new line, they'll be able to increase reserves up to 127,000,000 cubic feet per day from new fields in Jack and Wise Counties, Texas.

The Oklahoma Extension will tie in with the Company's mainline at a point near Fritch, northeast of Amarillo. It represents better than a 10% addition to their present pipeline network that includes 1400 miles for affiliate Texas-Illinois Natural Gas Pipeline Company and 1700 miles for Natural Gas Pipeline Company.

262 miles — of 26-inch pipe was furnished by A. O. Smith. In fact Natural Gas Pipeline Company and A. O. Smith have enjoyed a long and mutually satisfactory association. Over 1000 miles of the 30-inch pipe for the previously mentioned Texas-Illinois line was also supplied by A. O. Smith.

For almost 30 years . . . A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

Through research . . . *a better way*

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

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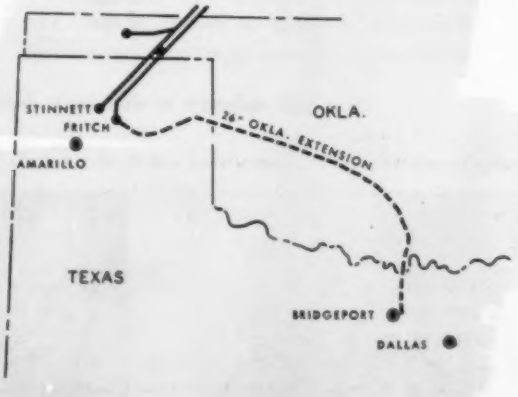
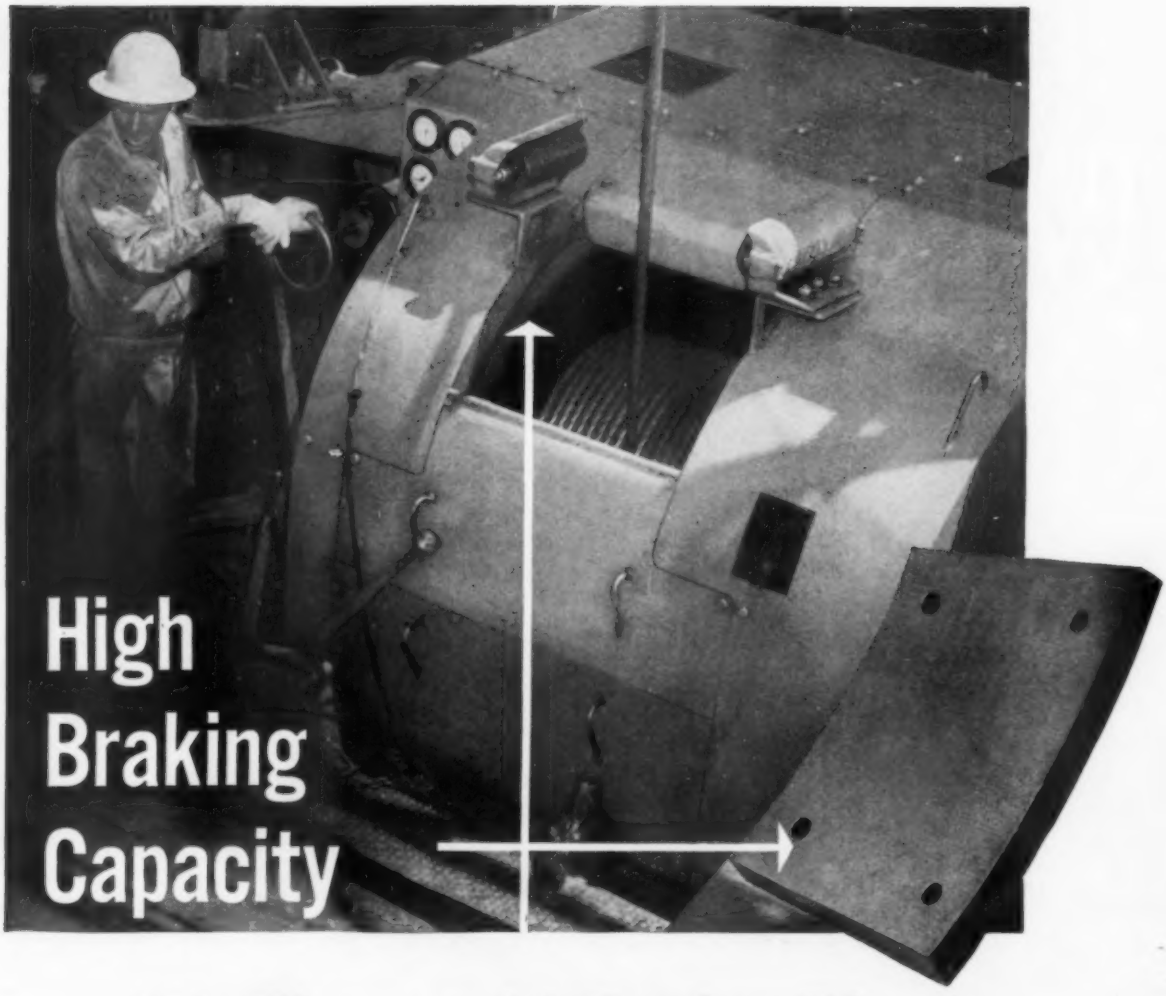
Chicago 4 • Dallas 35 • Houston 2 • Los Angeles 17 • Midland 5, Texas • New Orleans 12 • New York 17 • Tulsa 3 • A. O. Smith International S. A., Milwaukee 1, Wisconsin, U. S. A.

:expands reserves

Construction of the Oklahoma Extension, a four-month project, included erection of suspension bridges to carry the pipe over severely eroded terrain and a number of soil-conserving, erosion-control dams.



The 350-mile line extends from newly tapped fields in Jack and Wise Counties in Texas and swings north into Oklahoma and then back into the Panhandle to tie in with the Company's existing mainline near Fritch, Texas.

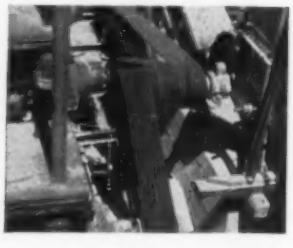


with Thermoid Brake Blocks

Choice of leading original equipment manufacturers and drilling contractors everywhere, Thermoid Brake Blocks withstand highest operating temperatures without crumbling or loss of shape. The solid woven asbestos tape (no plies) assures uniform friction, maximum safety, extra long life. Thermoid's special resins won't bleed or leave residue on drums. Split-type sleeve prevents 'chucking.' Because the braking surface is pre-ground to accurate limits, no 'running-in' is required.

On original equipment, or when you're making replacements, always insist on Thermoid.

Specify Thermoid Powerflex Rotary Hose and Multi-V Belts for rugged oil field service.



Thermoid

Thermoid Company
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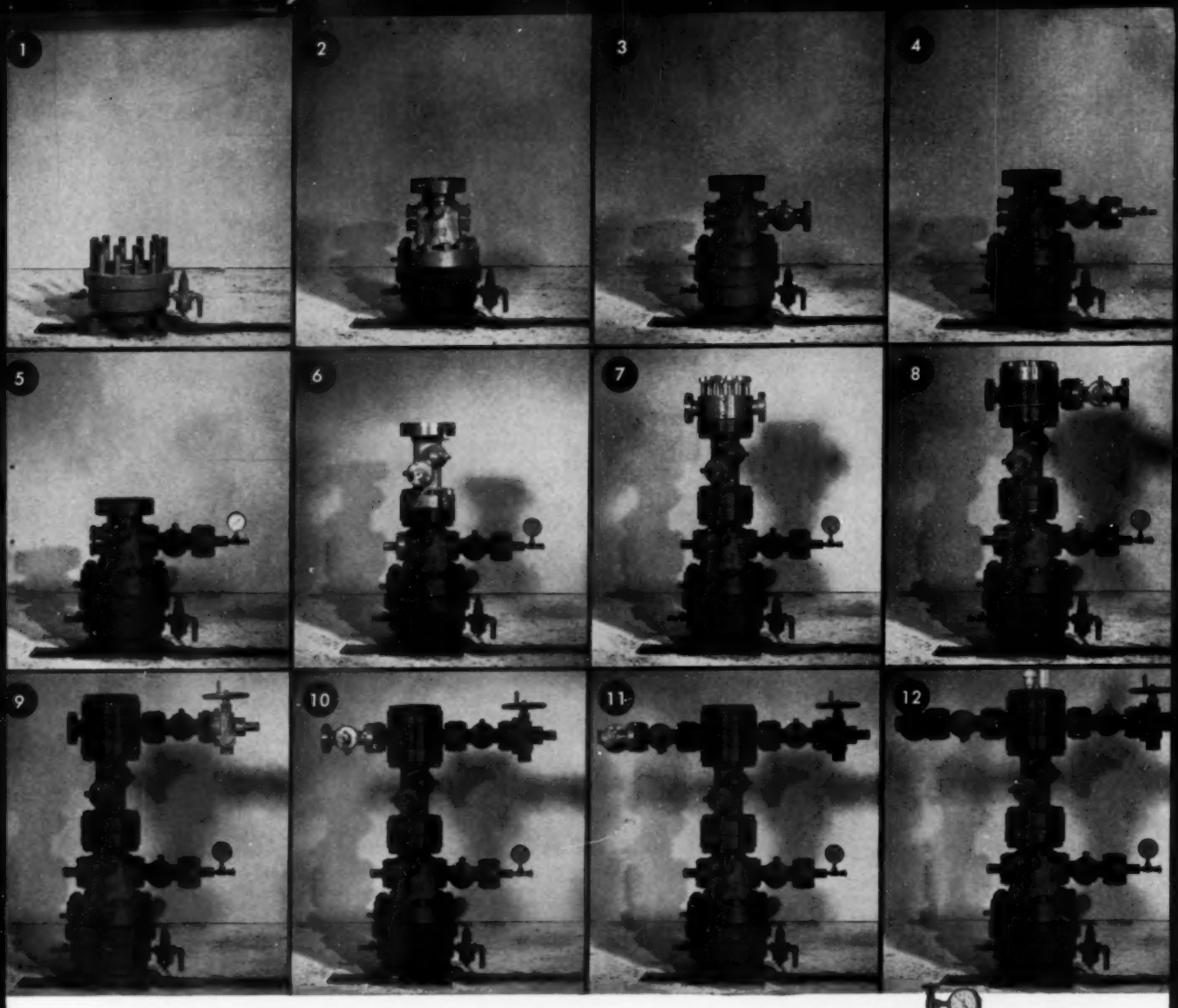
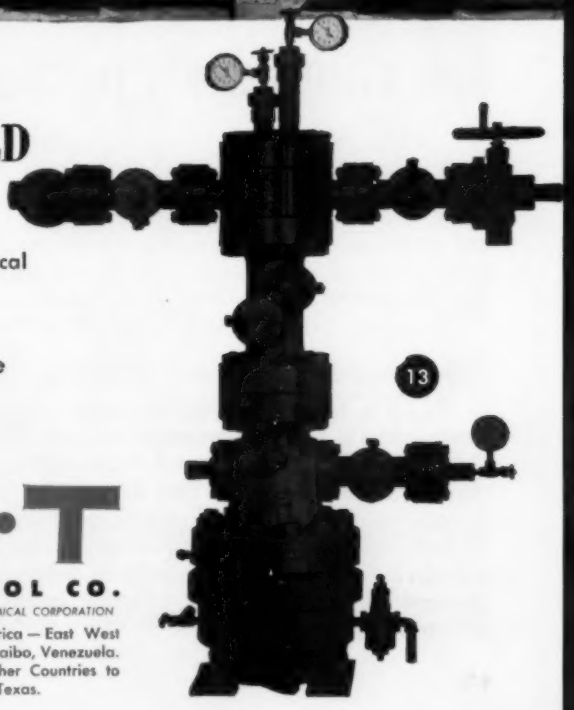


"STEP-BY-STEP STORY" of the BEST DUAL ASSEMBLY IN THE FIELD

From the first bolt to the last gauge, the dual tree shown above in the various stages of growth, represents the most practical and efficient dual well control equipment in the field.
It is an O-C-T Dual Tree, including the new and revolutionary O-C-T Universal Tubing Head.
Dual assemblies, pioneered by O-C-T and now improved to give you even greater versatility, answer long existing problems.
For deep or shallow multiple pay zones... if you make any kind of dual completion... make it O-C-T, the pioneer and leader in dual completion equipment.



where progress is a daily practice

O·C·T

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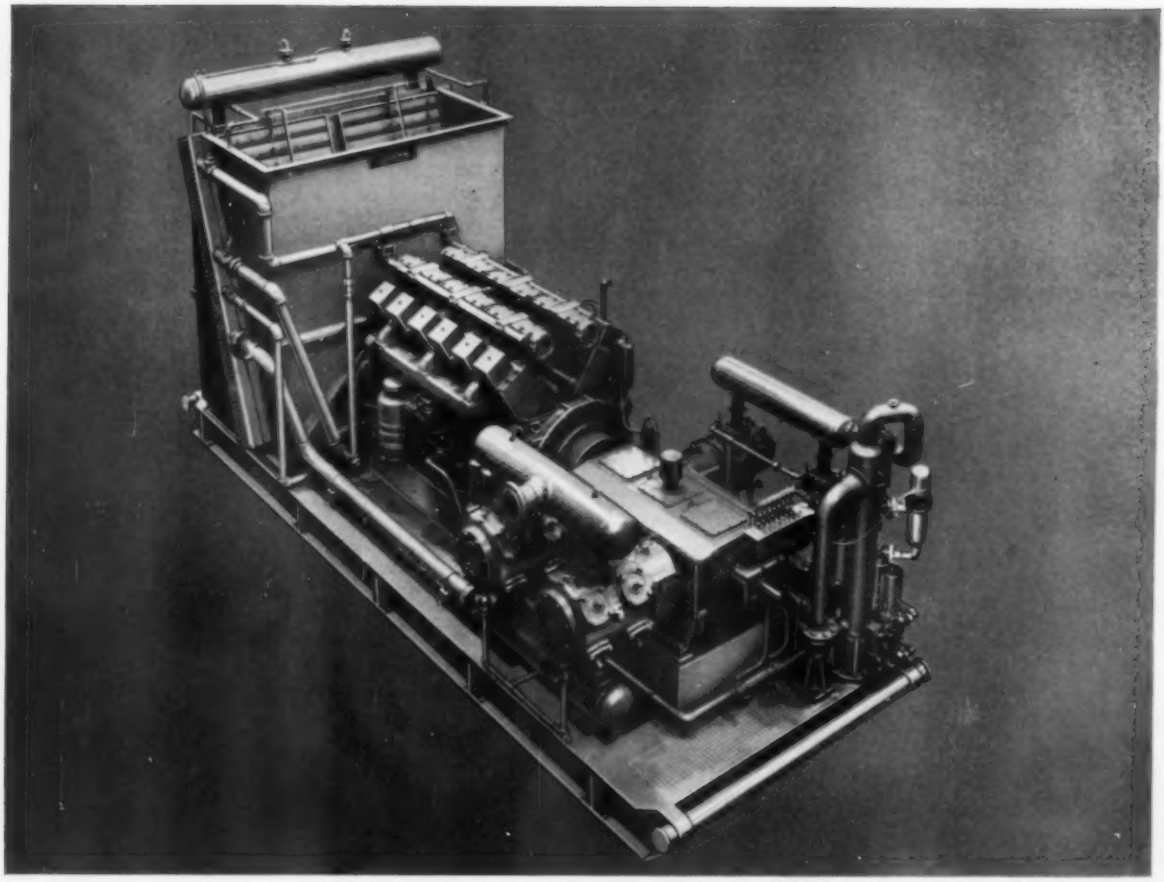


The Clark model CFA-4 is a completely self-contained compressor station. It is built in eight sizes ranging from 200 to 350 bhp.

Clark CFA balanced/opposed compressors are completely packaged for rugged field service

Portable, proved and popular, Clark CFA compressors are specifically built for air drilling, gas lifting, gas gathering, boosting, testing, repressuring, and other exacting oil-field services. These packaged units are available in two and four cylinder models, in sixteen sizes, covering a range of 100 to 350 bhp.

Direct drive assures greater efficiency

In the CFA, Clark engineers have done away with power-robbing, troublesome gears and belts between the engine and the compressor. A simple rubber block coupling takes their place. This direct drive feature is made possible by the perfect balance of the Clark CFA. It explains how the compressor can operate at a modern 1000 rpm. The direct drive design is also responsible for considerable reduction in skid size and in housing costs.

Balanced/opposed design eliminates vibration

Compressor cylinders are mounted on opposite sides of the crankcase and are connected to crankthrows which are 180° apart. With this arrangement, reciprocating masses, which are of equal weight, are always moving in opposite directions. Because there are no unbalanced forces, vibration is practically non-existent and operating costs are cut down and kept to a minimum.

Easier to install, move or shelter

Since the CFA is a self-contained compressor station, installation presents no problem. Just enough concrete to level the unit is all that is required. Clark CFA's are excellent compressors for swamp country, as well as barge and truck mountings. For air drill-

ing, you can even mount the compact CFA on timbers. It won't "walk" away.

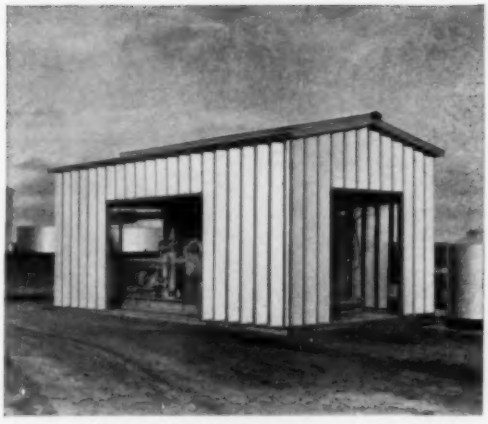
Unitized radiator simplifies cooling

All cooling services are efficiently handled by the unitized radiator built right on the skid . . . and include engine water jacket, compressor cylinder water jacket, lube oil cooling, and as required, inter and after cooling of the gas stream.

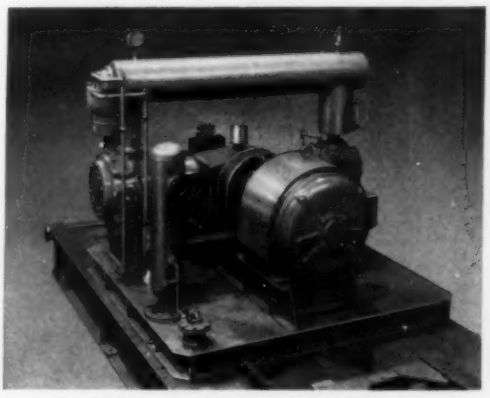
CFA contains many "big compressor" features

Into the sturdy Clark CFA have been built many "big compressor" features. These include a steel crankcase, a one-piece forged steel crankshaft, forged steel connecting rods, precision bearings, and forced feed lubrication. You will find that you'll deplete the field, but you won't wear out the Clark CFA.

The Clark *encyclopedia of experience* — in design, manufacture, and application is always at your service. For complete data on all CFA balanced/opposed compressors, call your nearby Clark engineer. Or write today for the new Composite Catalog, Bulletin No. 151 to Clark Bros. Co., 1105 Lincoln Avenue, Olean, N. Y. Clark is one of the Dresser Industries and maintains sales and service outlets in principal cities throughout the world.

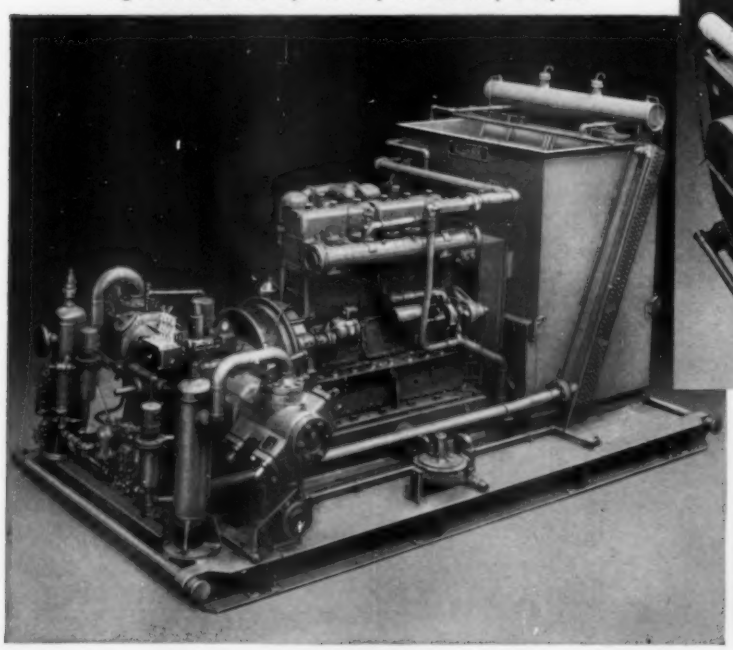


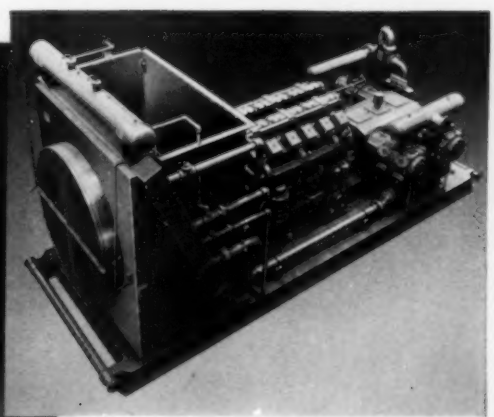
Here a 128 bhp Clark CFA-2 does heavy duty in a field installation for gas gathering. Note the simple installation.



The CFA-2 is also available in electric motor driven units if desired. Illustrated is the 100 bhp model.

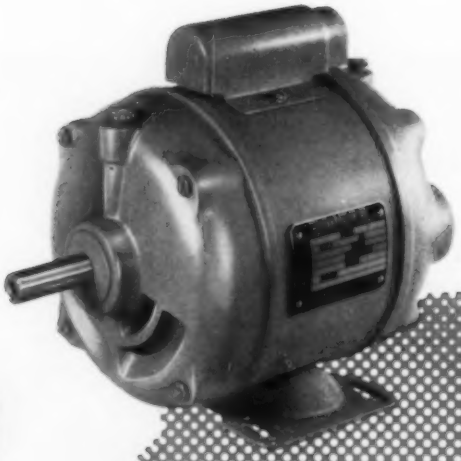
Below: The completely packaged CFA-2 comes in eight sizes ranging from 100 to 200 bhp. No costly field assembly is required.





The unitized radiator in this CFA-4 handles *all* cooling services in one efficient operation. Piping is confined to skid for maximum protection.

CLARK®



FOR 1/8 THRU 400 H. P. MOTORS

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All Enclosures—Most Types—Integrated Drives.

You get a great big plus value with Master motors—fractional and integral H.P. And that is that every one of them is engineered to meet your drive requirements *exactly*—to combine, if desired, in one tidy, efficient package with other Master components.

So for any drive requirement—simple or complex—a glance at the data below will show you that Master is your best bet. Let us tell you more.

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Motor Types .....Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.

Construction .....Open, enclosed, fan-cooled, explosion-proof, special purpose.

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Power Drive Features .....Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

THE MASTER ELECTRIC COMPANY • Dayton 1, Ohio

DIVISION OF RELIANCE ELECTRIC AND ENGINEERING CO.

USCOFLOW PLASTIC PIPE

New black UscoFlow Utility plastic pipe and fittings provide economical corrosion resistance—inside and out

A blend of styrene-base resins and synthetic rubber to give good impact resistance and high, effective tensile strength...

A simple installation—rapidly solvent welded...

A friction-free finish that maintains high flow-rate and resists build-up of scale or other deposits...

An economical price to solve corrosion and high installation cost problems that would ordinarily chew into your profits...

All this is the *new* UscoFlow line of black plastic pipe and fittings, specially designed for economical and efficient handling of fluids. It has already proven its long service life, free of maintenance and downtime, and is recommended for such applications as

salt-water lines **fresh-water lines***
natural-gas lines **electrical conduit**

A full selection of UscoFlow pipe and fittings—plus expert engineering assistance—is available at any of the selected "U. S." Distributors, at "U. S." Branch Offices, or by contacting us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

**Uscolite is approved by the National Sanitation Foundation for use with potable water.*

Mechanical Goods Division

United States Rubber

See things you never saw before. Visit U. S. Rubber's new Exhibit Hall, Rockefeller Center, N. Y.

Lower away with Tiger Brand Rope – and lower your costs

Stringing 30-inch pipe on the Texas Eastern line near Waynesburg, Pa. General Contractor: Williams Bros.; Stringing Contractor: Parkhill Truck Co., both of Tulsa.

Loading pipe with a crane rigged with USS American Tiger Brand Wire Rope and Sling. Ray Herron (left) of Parkhill and Charley Pool, who sold the rope.

THESE BIG 30-inch pipe sections weigh 3 to 4 tons each and they put plenty of strain on the wire rope. Operating conditions are severe. To get the longest service out of the wire rope, Parkhill Truck Company of Tulsa used American Tiger Brand 6 x 19 Monitor Excellay with Independent Wire Rope Core.

This rope is a favorite for rough service on all kinds of pipeline jobs. It is tough and strong—can take it when the going gets hard. Use it regularly and you'll save money on wire rope.

Tiger Brand Wire Rope is carried in stock by leading distributors wherever you go. Ask for it by name.

AMERICAN STEEL & WIRE DIVISION
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Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

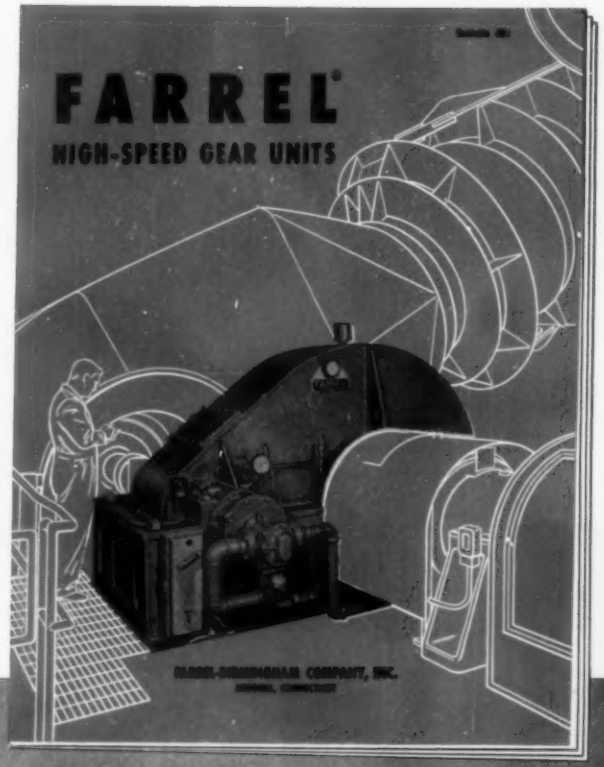
NEW REFERENCE MANUAL

...to help you choose dependable high-speed gear units

Here is one of the handiest manuals on high-speed gear units ever offered. It covers both speed-increasing and speed-reducing units.

Every one of its 28 pages is designed to help you in the efficient selection and application of Farrel SI units. Concise yet complete, the booklet makes it easy for you to choose the proper unit for long service life and trouble-free operation. Diagrams illustrate twelve alternative lubrication systems designed to meet individual requirements.

For your free copy, just fill out the coupon and mail it today.



FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, Boston, Akron, Ann Arbor (Mich.), Chicago, Minneapolis, Fayetteville (N. C.), Los Angeles, Salt Lake City, Tulsa, Houston

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What the booklet contains:

- Description of the units
- General specifications
- Instructions for selecting a unit
- Selection examples
- Table of ratio factors
- Service factor table
- Table of horsepower ratings
- Ordering instructions
- Dimension drawings
- Alternate lubrication systems
- Illustrations and descriptions of eight special test-stand units
- Installation photographs
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Engineers will find this factual manual useful in the selection of drives for a variety of applications. Send the coupon for your free copy.

FARREL-BIRMINGHAM COMPANY, INC., Ansonia, Conn.

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Tough valve buyers appreciate this kind of... Toughness

*HAYNES STELLITE

Here's why:—They know that to foil those troublesome valve "termites"—erosion, corrosion, and galling—requires built-in toughness which only seats faced with hard facing alloys AND hardened wedges can provide. Yes, it takes BOTH to do a real job and GP Valves provide both at no extra cost!

Vogt GP Valves feature the toughest and, since they are precision finished, the smoothest seating surfaces obtainable anywhere. That's why they are setting new standards of performance—longer, drop-tight service with minimum, low cost maintenance—in petroleum refineries, chemical plants, power plants and other industries. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850° F. and 2000 pounds at 100° F.

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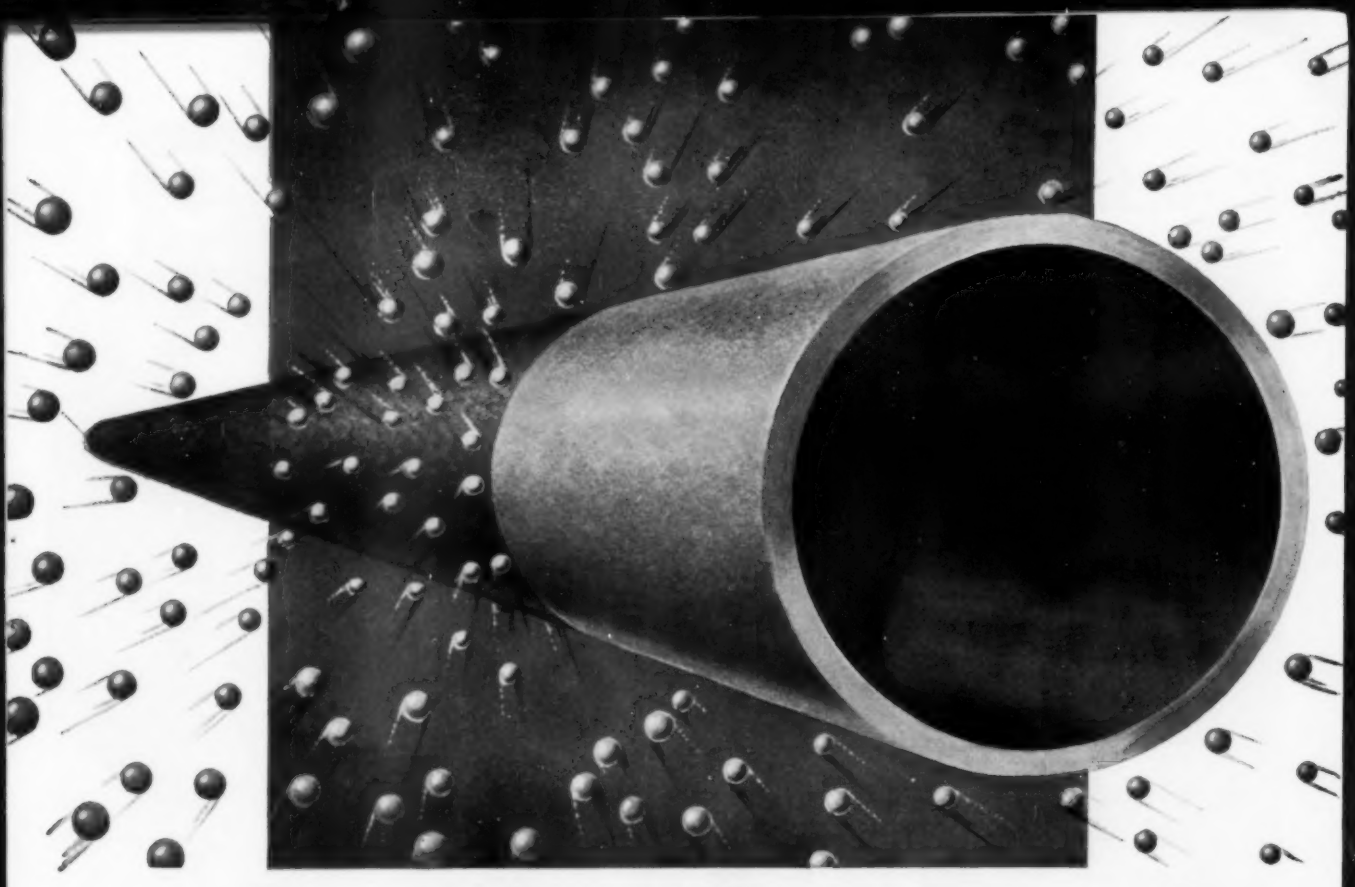
DROP FORGED STEEL

VALVES

HAYNES STELLITE—Trade-mark of Union Carbide and Carbon Corporation



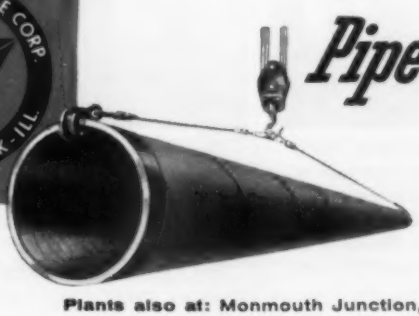
Steel Shot Cleaning makes Pipe Protection Stay Put

Applying protective coatings to improperly prepared pipe surface makes about as much sense as building a skyscraper on sand. Pipe Line Service has always pioneered in developing new ways to insure a good bond . . . a bond that makes protective coatings practically inseparable from the pipe itself.

An outstanding example is steel shot cleaning. Special machines permit bombardment of the pipe surface with millions of steel pellets traveling at high speed. Result? Not simply removal of mill scale and rust . . . but actually an "etching" of the steel surface. This slightly roughened surface allows the protective coating to "take root"—gives you the years of protection that you should have.

We emphasize Pipe Line's steel shot cleaning process because it was one of the great steps forward in maximum protection of *your* pipe investment. It's a manufacturing extra that's provided at no extra cost . . . and one more reason for extra confidence in specifying protection by PLS!

PIPE LINE SERVICE CORP. SERVICE EQUIPMENT MATERIALS FRANKLIN PARK - ILL.



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General Offices and Plant: Franklin Park, Ill.

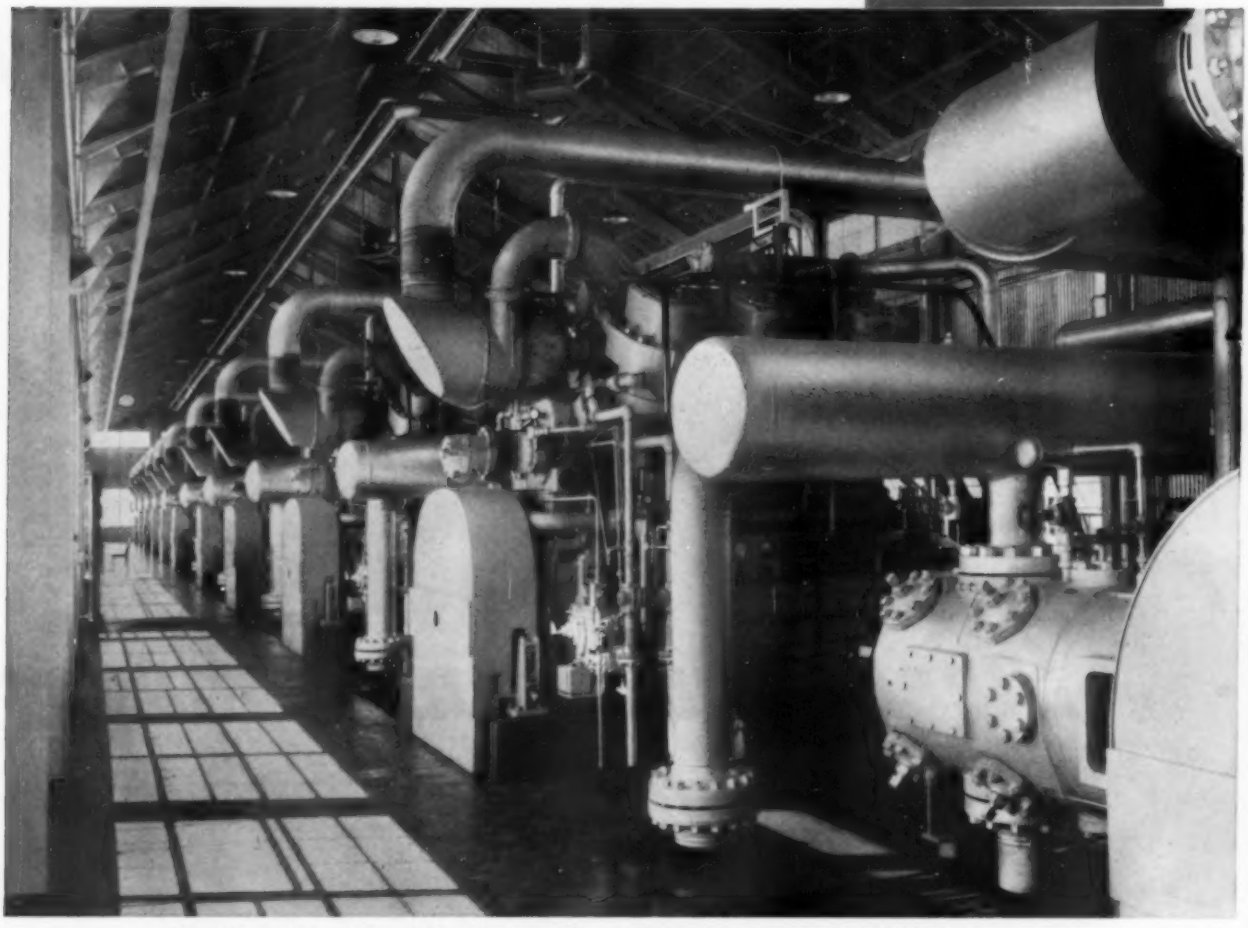
Quality pioneers in coating and wrapping pipe for over a quarter century

A SUBSIDIARY OF AMERICAN STEEL FOUNDRIES

Plants also at: Monmouth Junction, N. J.; Glenwillard, Pa.; Sparrows Point, Md.; Longview, Tex.; Corpus Christi, Tex.; Provo, Utah; Harvey, La.

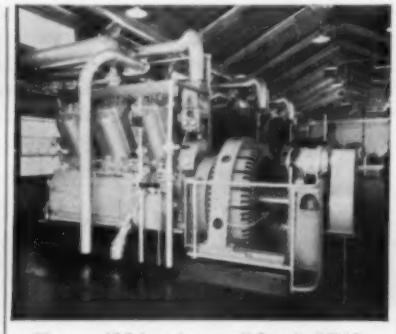
Sales offices at all plant locations . . . and Atlanta, Ga.; Houston, Tex.; Lincoln, Nebr.; Tulsa, Okla.

11 TURBOCHARGED KVS

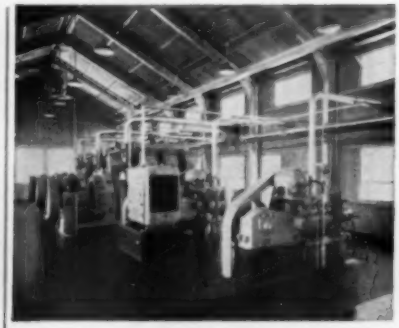


Eleven Ingersoll-Rand turbocharged 4-cycle KVS gas-engine compressors, totaling 20,000 hp, in main compressor building of Michigan Consolidated Gas Company, Six Lakes, Mich. The two sizes of compressors are identical in operation and have almost complete parts interchangeability.

Compressor side of 2000-hp KVS unit, showing the "compound" clearance pockets in the head ends of the compressor cylinders. These, together with pockets in the frame ends, permit 4-step loading of each cylinder.



Three 408-hp Ingersoll-Rand PSVG gas-engine-generator units provide all electric power for the Six Lakes station. These dependable 4-cycle, V-angle gas engines offer the same flexibility of speed and load as the large KVS compressor units.



Two Ingersoll-Rand two-stage ES compressors supply starting air for the KVS gas-engine compressors and the PSVG engine-generator units. Both have overhead-mounted electric drive; one also has standby gasoline-engine drive.

GAS-ENGINE COMPRESSORS

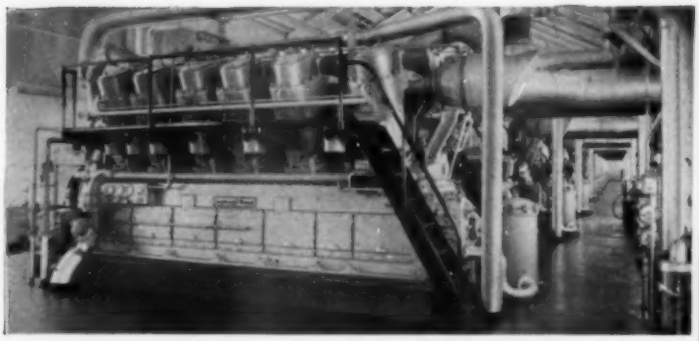
show ultimate flexibility

at Six Lakes Storage Field

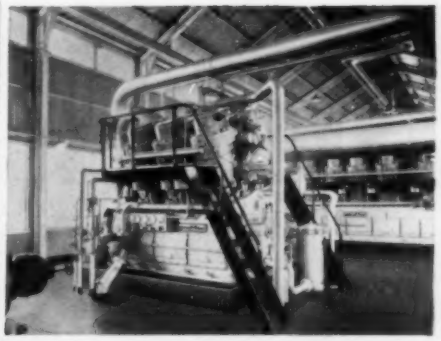
Michigan Consolidated Gas Co. uses

from zero to 20,000 hp in many steps

with fluctuating pressures and capacities



One of nine 12-cylinder, 2000-hp turbocharged KVS compressors, from engine side.



One of two 6-cylinder, 1000-hp turbocharged KVS compressors, from engine side.

In the compressor station at Michigan Consolidated Gas Company's Six Lakes Storage Field, an all-Ingersoll-Rand installation provides the ultimate in loading flexibility. Two sizes of turbocharged 4-cycle KVS gas-engine compressors, with something new in capacity-control cylinders, allow almost infinite-step regulation from part of one cylinder to full-load on 40 cylinders.

The Six Lakes station takes from the pipeline whatever amount of gas is not currently needed by the Detroit area, and stores it underground for use when winter's demands exceed the pipeline capacity. By its nature, this type of service means that the compressors must be able to handle any load from a mere trickle to millions of cubic feet per day. Also, since the pressure of the storage field varies with the amount of gas in it, the compressors must be extremely versatile to handle many different pressures as well as fluctuating capacities.

At this station, different combinations of the nine 2000-hp and two 1000-hp Ingersoll-Rand KVS compressors may be used to provide 20 load steps in 1000-hp increments even with all cylinders loaded. The capacity of each cylinder of each machine can also be controlled in four steps by a unique method which I-R developed for this service.

In addition to this outstanding flexibility, there is easy speed control without sacrifice of gas and oil economy—another Ingersoll-Rand 4-cycle characteristic.

Also at the Six Lakes station, three 408-hp Ingersoll-Rand 4-cycle, V-angle PSVG gas-engine-generators supply all A-C power. Starting air for both the KVS compressors and the power units is supplied by two Ingersoll-Rand ES compressors—one with electric drive, and a standby unit equipped with gasoline-engine drive.

The exact compressor and power requirements for *any* pipeline application can be met with dependable, time-proven Ingersoll-Rand 4-cycle, V-angle engine equipment. Your I-R representative will be glad to give you complete information. Call or write now.

Only IR compressors have CHANNEL VALVES

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of straight-lifting stainless-steel channels and leaf springs, with trapped-air spaces which cushion action, prevent impact.

Ingersoll-Rand

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4-CYCLE

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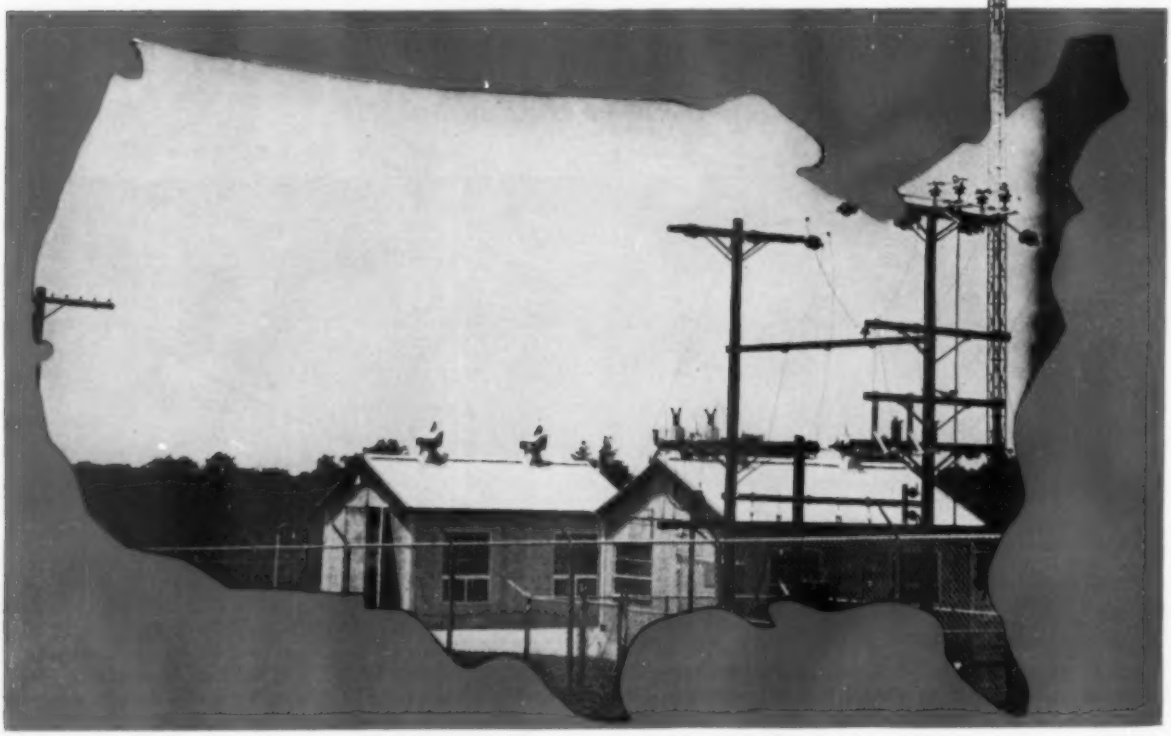
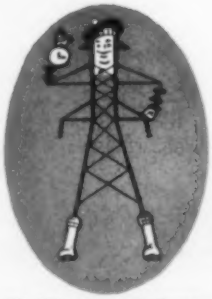


One of many ways progressive management puts UTILITY ELECTRIC POWER to work

If you are in the pipe line transmission business . . . or if you contemplate having anything to do with pipe line transmission operations, don't sign any contract for power until you have carefully investigated the advantages of UTILITY ELECTRIC POWER. Of the 686,000 miles of pipe line systems in America, a big percentage of these is operated by Electric Power. When you have deliveries to make – at low cost – do it the modern, progressive way. Use UTILITY ELECTRIC POWER.



I'M LCP – Low-Cost Power on the Job 24 Hours Daily

PETROLEUM ELECTRIC POWER ASSOCIATION
P. O. BOX 35006 DALLAS, TEXAS

with Vornado® automobile air conditioning!

Tests on the blistering Arizona Desert proved it! Automobile air conditioning actually makes drivers safer, healthier, more comfortable. The business man who spends hours a day in his car FEELS better... LOOKS better, and SLEEPS better – when his car is air conditioned by Vornado!

For thousands of torturous miles in sweltering heat – two matched college athletes drove from Phoenix to Yuma, Arizona, and back...on the blistering Arizona desert... EVERY DAY! They alternated driving a Vornado Automobile Air-conditioned car a week at a time.

HERE ARE THE RESULTS! While driving the Vornado air-conditioned car – each driver felt better, ate better, and slept better...depth perception improved!

While driving an *identical* non-air-conditioned car – each driver lost weight, complained of stomach cramps, experienced *highway hypnosis, showed a* DANGEROUS *loss of depth perception and suffered extreme fatigue!*

COMPANY OFFICIALS—FLEET OWNERS!

Contact us today for our special fleet program! ***now available:*** *15-Minute, Full-Color Sound Film on Vornado's Daring Arizona Desert Test* (16 mm) sent on request for industrial showings. Write us today!

VORNADO LETS YOU *Start cool... Drive cool... Arrive cool!*

Exclusive Curved Cooling Coil—⅓ greater area than most! / Five Air Circulators—2 more than most! / Three-Speed Blower Control—for every hot-weather condition! / Automatic Thermostat—no freeze-up! / Giant Arctic Compressor—for powerful cooling action! / Fast Installation! Full Factory Warranty! / NATIONWIDE SALES AND SERVICE

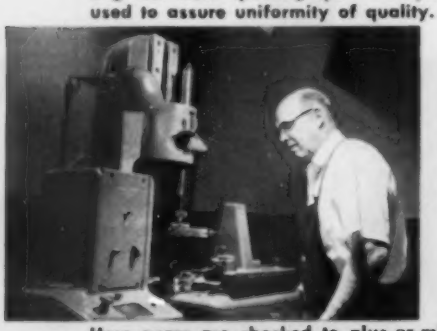
Vornado®

A product of

THE O. A. SUTTON CORPORATION, INC., Wichita, Kansas

World's leading full line manufacturer of comfort cooling appliances

1 The buyer of a Continental "S" assembly receives full benefit of the advanced practices which maintain quality in new engines. Here spectrographic analysis is used to assure uniformity of quality.



2 Here gears are checked to plus-or-minus .0003, on the involute checker, while results are recorded on a continuous chart.

3 Live steam under high pressure removes all foreign matter from inside engine block.

4 End play is checked, and all lines are oil tested, just as in new engine assembly. Then bearing caps, cylinder heads, gear covers, and filler blocks are all torqued to specifications.

In the Oil Field, too . . .

CONTINENTAL

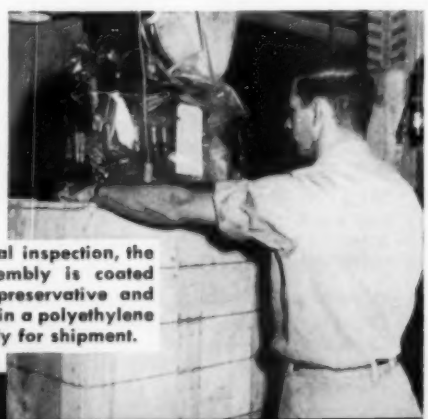
"S" Assemblies Cut Costly Down-Time

•

In all branches of the petroleum industry—producing, processing, distribution—Continental Motors "S" Assemblies are saving their cost—often many times over—by minimizing the time required to keep essential equipment running. Every Continental model is now available in "S" Assembly form—basic engine unit complete with cylinder-and-block assembly, oil pan, cylinder head, piston and valve assemblies, crankshaft, camshaft, gear cover, bearings and caps, crank and cam gears, and front end plate, fully assembled and torqued to specifications, ready to install in a fraction of overhaul time . . . Note too, that the program enables the owner to keep every power plant modern-to-the-minute, since "S" Assembly parts incorporate all the latest results of Continental research, as regards both material and design. It will pay you to investigate. Write for information.

•

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD



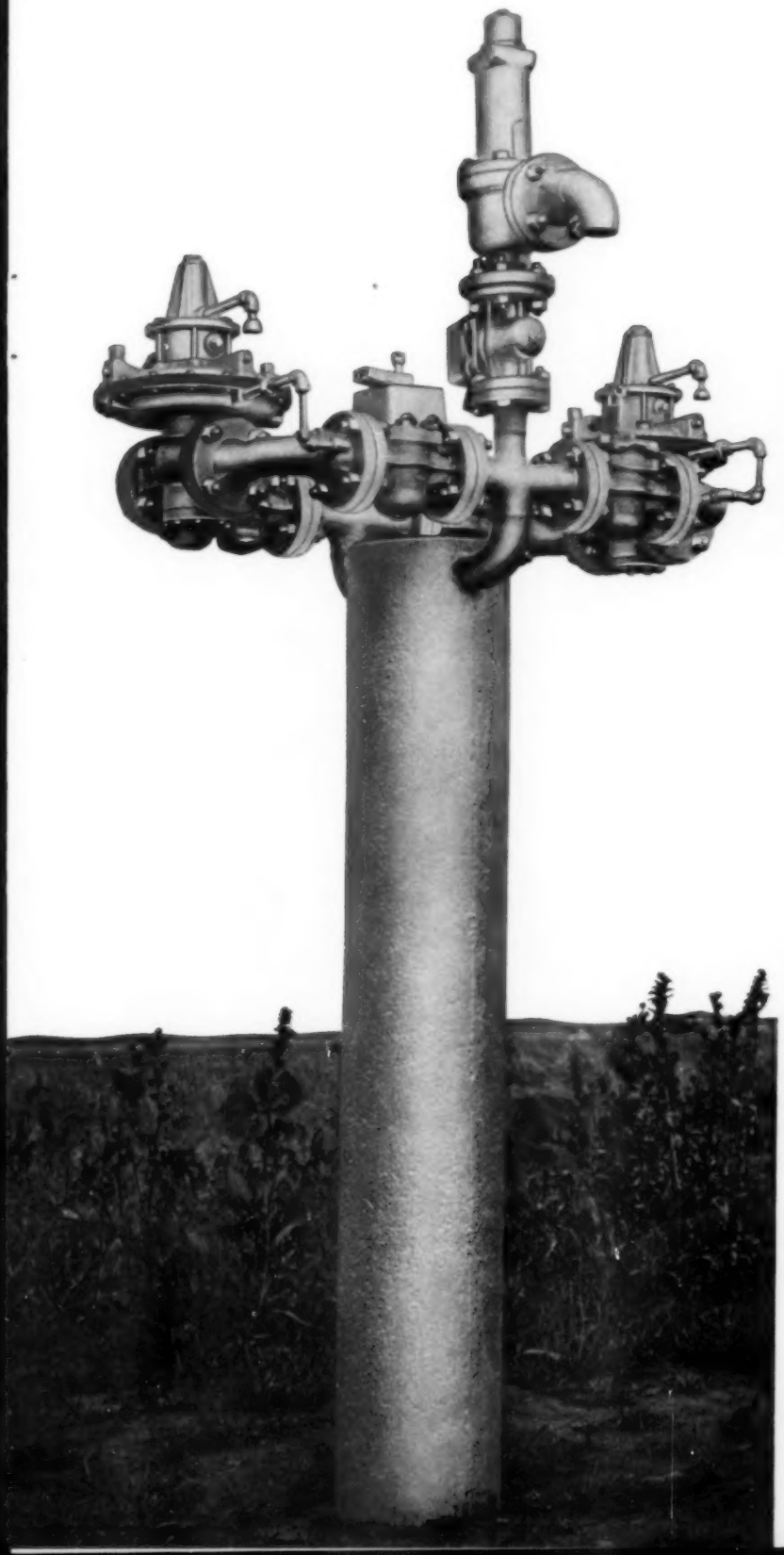
5 After final inspection, the "S" assembly is coated with a preservative and encased in a polyethylene bag ready for shipment.

Continental Motors Corporation

MUSKEGON • MICHIGAN

Why go down . . . when you can go up?

AND GET BETTER DISTRICT PRESSURE CONTROL



Why dig a costly vault when you have only a small distribution segment to serve from a high pressure line? Why not raise your pressure controls above ground and do the job quicker, better, more economically with Rockwell "1001" regulators and Rockwell-Nordstrom valves? There's no worry over tampering with this type installation. The Rockwell "1001" has a completely enclosed *power pilot* loading system. And Rockwell-Nordstrom valves can be fitted with locked hoods.

You'll get the highest degree of control accuracy with "1001" regulators . . . and at a most attractive price. Alert gas engineers find uses for them everywhere. They stock these versatile, compact, all-purpose regulators in anticipation of regular needs and emergencies. Write for bulletin 1059.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

ROCKWELL "1001" REGULATORS

A Thousand and One Uses in the Gas Industry

IN the gas business you can't be half safe. The equipment you use, its installation and operation all must meet the highest security standards.

We at Rockwell carefully design and rigorously test our products with safety in mind.

One example: To resist impact, Rockwell meters are made with sturdy

SAFETY

A built-in bonus in Rockwell products

one-piece bowl type bodies. And they have but a single main joint to seal against leakage.

Another: Completely encased Rockwell regulators discourage tampering —protect against shock. Where the flexibility of outside weights is desired or where internal pressure relief is desirable, regulators with auxiliary safety controls can be recommended and furnished.

All Rockwell meters and regulators are tested before shipment at least double their rated working pressure. And all casting designs undergo a series of rupture tests at elevated pressures before release to production.

Because of such precautions, buyers of Rockwell equipment enjoy the peace of mind that comes only through use of the finest, safest equipment. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

FOUR WAYS IN WHICH ROCKWELL EXCELS

RESEARCH • SAFETY • ACCURACY • SERVICE

ROCKWELL GAS METERS AND REGULATORS

Which has the greater surface area?

Not the football field! One cubic inch of Davison Silica Gel boasts a surface area of about 90,000 square feet . . . much more than a football field. It's a high capacity desiccant!

Davison Silica Gel adsorbs about 45% of its weight of water from saturated air. What makes it so vapor "thirsty"? One, its enormous internal surface. Two, its millions of tiny pores or capillaries. These *attract* vapors, *condense* them, *hold* them as liquids.

That's why you'll find Davison Silica Gel so efficient in drying air and gas. A variety of particle sizes, densities and adsorptive capacities are available. Each has been developed to meet specific application demands. There is one to suit yours.

DAVISON
CHEMICAL COMPANY
Division of W. R Grace & Co.
Baltimore 3, Maryland

NATIONAL LINE PIPE

reaches across America...

Seamless and Electric Weld

"The world's finest tubular products
from the best-known name in pipe—
NATIONAL TUBE"

National Tube
Division of USS United States Steel

USS and National are registered trademarks.

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

3 Reasons Why Your BEST TANK BUY is BOLTED STEEL TANKS

MASTER-CRAFTED BY COLUMBIAN
SINCE 1893

1. They Fit Up Better
2. They Stay Tight
3. You Get Them Fast from Columbian Distributors

Specifications and prices are pretty much alike, no matter what make of tank you buy. But you *can* get more for your tank money when you specify Columbian Bolted Steel Tanks. "Master-Crafted by Columbian"—precision manufacture by the most modern techniques plus old-fashioned craftsmanship—means that every Columbian Tank will fit up easily and fast. As a result you get a tighter tank throughout its long life.

And when, as always, time means money—you're money ahead to order from your nearest Columbian Distributor. He'll have the size you want quickly available at your site.

LOUISIANA
McGuffin Tank Co.
P. O. Box 724
Shreveport, La.

McClatchey Tank & Supply Co.
Lafayette, La.

NEW MEXICO
Allied Supply Co.
P. O. Box 217
Artesia, N. M.

American Tank & Steel Co.
P. O. Box 1177
Farmington, N. M.

TEXAS
Gray-Brown Tank Co.
P. O. Box 924
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Mapp Tank Co.
P. O. Box 1349
Odessa, Texas

Martin Tank Co.
P. O. Box 135
Corsicana, Texas
Kilgore, Texas

Federal Tank Co., Inc.
First State Bank Bldg.
Bellaire, Texas

TEXAS (Cont'd)
Texas Gulf Tank Co.
P. O. Box 14281
Houston, Texas

Westex Tank Co.
P. O. Box 941
Odessa, Texas

Columbian Steel Tank Co.
(warehouse)
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Houston, Texas

B. A. Box
P. O. Box 42
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COLORADO
O'Neill Tank Co.
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KANSAS
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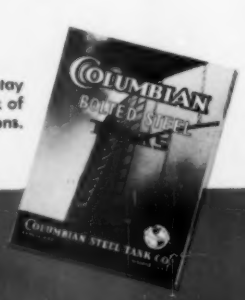
COLUMBIAN STEEL TANK CO.
P. O. Box 4048-J Kansas City, Missouri

Want to know WHY Columbian Tanks stay tighter? Send for this unusual handbook of valuable information and specifications. It's FREE!



TANKS FOR THE WORLD

STEEL, Master-Crafted by Columbian . . . First for Lasting Strength

They Say-

Arizona prediction gets nod

Dear Sir:

I read The Oil and Gas Journal assiduously (whatever that means) and I sure did get a real kick out of your exploration article on page 141 of the February 3 issue, stating that Arizona is the state to watch in 1958. I quite agree with you in that statement for the simple reason that I really do know what is going on here, having had my fingers on the pulse of the situation for years. . .

Fred Blair Townsend
Phoenix, Ariz.

Let's not hang ourselves

Dear Sir:

Without doubt, the oil industry has the poorest public relations of any major industry. The oil industry is solely to blame for its plight, and as long as mediocre leadership exists, the whole situation will deteriorate further and conceivably nationalization of this industry will take place. . .

The oil industry seems to think that talking to itself is going to get the job done. Trade journals carry article upon article upon article dealing with arguments for or against legislative matters directly affecting the industry. . .

The great mass of population . . . never see any of this material . . . The members of Congress are receiving thousands of opposition letters relative to any favorable legislation in behalf of the oil and gas industry.

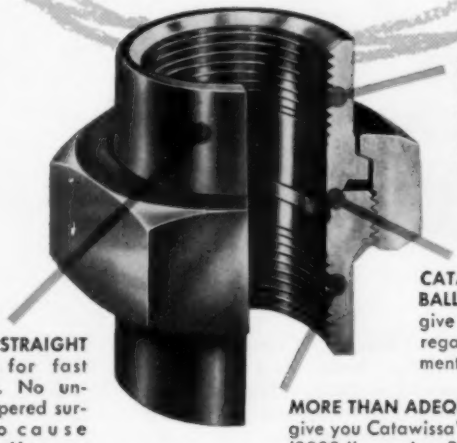
What other course can these constituents take when they are furnished with only one side of the picture . . . Leaders in the oil industry sit back . . . not one move has been taken toward a coordinated effort to furnish reliable information to the general public.

If the papers will not furnish the public with both sides of the argument, then the industry must pay for its space. Every local paper should be made to carry the industry's argument to the public through properly planned paid advertising.

There should be an intelligently prepared weekly or biweekly program for television, 1 hour long, at the right time, on a national network. . .

There should be a permanent public-relations committee created to serve the whole of the industry within the law and the members of this committee should not be appointed according to their wealth or titular posi-

only
CATAWISSA
gives you all these features for your forged steel pipe union requirements



UNIFORM WALLS for even expansion and contraction under temperature changes. THEY FOLLOW THE PIPE!

CATAWISSA BALL-TO-ANGLE SEATS give you a "Perfect Seal" regardless of pipe alignment!

ROUND, STRAIGHT BARRELS for fast wrenching. No uneven or tapered surfaces to cause wrench slips or wrench locking!

MORE THAN ADEQUATE wall thicknesses give you Catawissa's 3-to-1 Safety Factor (3000-lb. service, 9000-lb. test; 6000-lb. service, 18000-lb. test)!

Catawissa Perfect Seal Pipe Unions are made by Union Specialists from 80,000-lb. tensile strength steel (ASTM Spec. A-105-55T, Grade II). Steel forgings from our own forging mill are closely checked for imperfections . . . and finishing on modern, automatic machines with close inspection during and after production give you pipe unions second to none!

Get your free copy of Catalog 56 showing the complete Catawissa line . . . write direct or stop at your favorite supply store.

CATAWISSA VALVE & FITTINGS COMPANY • CATAWISSA, PENNA.

for complete, guaranteed pipe union satisfaction

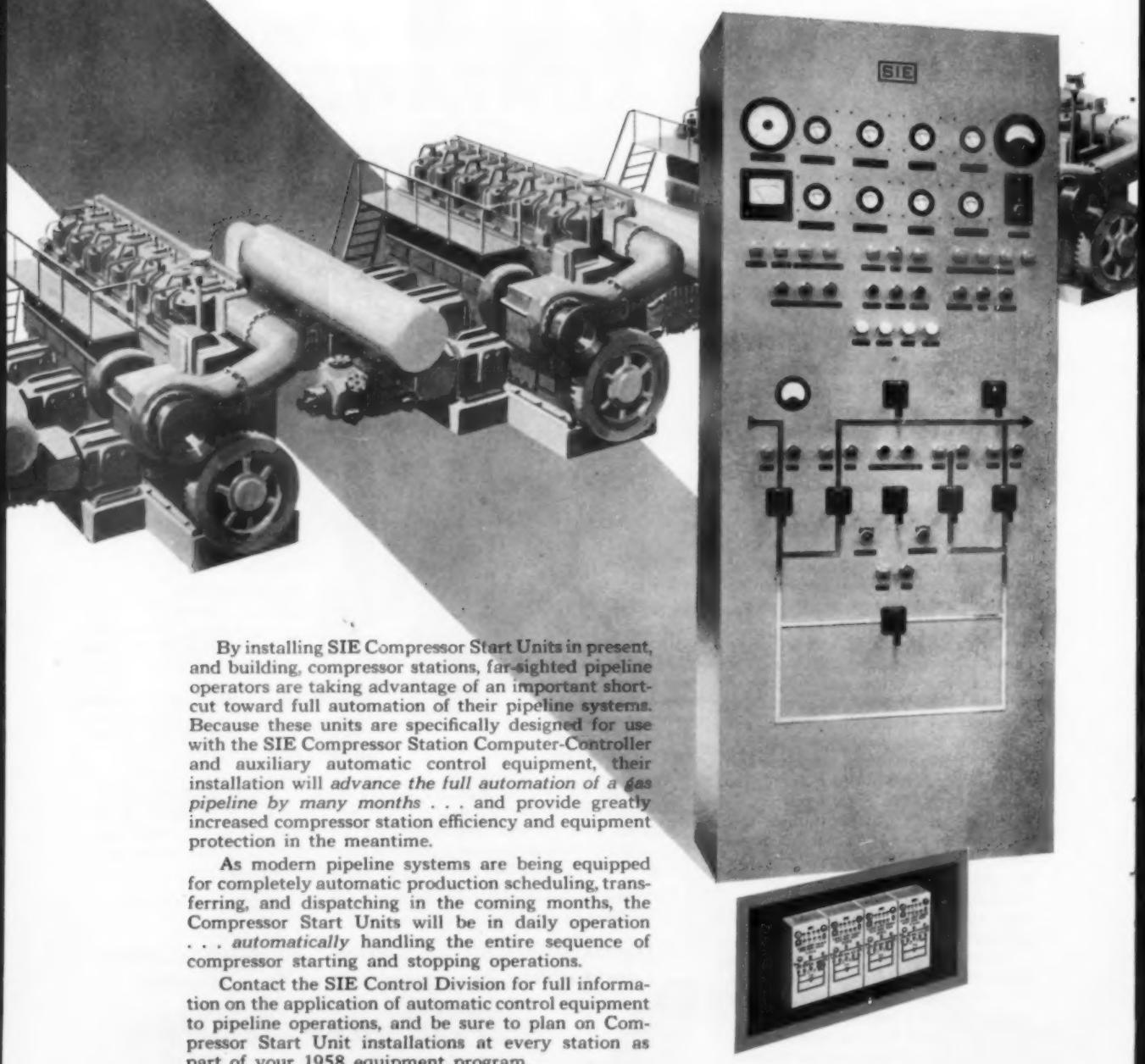
. . . always specify
CATAWISSA

. . . at your favorite supply store

SIE®

Compressor Start Unit.....

A new Dresser Industries contribution toward a *FULLY AUTOMATIC PIPELINE!*



By installing SIE Compressor Start Units in present, and building, compressor stations, far-sighted pipeline operators are taking advantage of an important short-cut toward full automation of their pipeline systems. Because these units are specifically designed for use with the SIE Compressor Station Computer-Controller and auxiliary automatic control equipment, their installation will *advance the full automation of a gas pipeline by many months* . . . and provide greatly increased compressor station efficiency and equipment protection in the meantime.

As modern pipeline systems are being equipped for completely automatic production scheduling, transferring, and dispatching in the coming months, the Compressor Start Units will be in daily operation . . . *automatically* handling the entire sequence of compressor starting and stopping operations.

Contact the SIE Control Division for full information on the application of automatic control equipment to pipeline operations, and be sure to plan on Compressor Start Unit installations at every station as part of your 1958 equipment program.

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO.

P.O. Box 13058 2831 Post Oak Rd. Houston 19, Texas

SIE

tion in a company but according to their ability to produce. . . We must have competent public-relations men for a public-relations job.

The timetable for this positive action is now, not tomorrow or next year. By then we will have pulled the rope too tight around our necks.

Dan Kralis
Manager,
Exploration and Production
Clark Oil & Refining Corp.
Denver

Need for gas bill unchanged

"The free and responsible American petroleum industry, regardless of events over which it has no control, continues to advocate enactment of H.R. 8525, the 'gas bill.'

"The 4-year experiment with the present system of federal regulation has proved unworkable. This is recognized by the Federal Power Commission itself. President Eisenhower has twice recommended the principles of this bill as a means of protecting consumer supplies.

"The nation is threatened with a breakdown in the supply of natural gas. It is irresponsible to divert the Congress from proper action of legislation that is vitally needed in the public interest . . .

"The Natural Gas Producers Regulatory Act is a just bill, a needed bill, and a responsible bill. The need for its enactment is as urgent now as when the week began. The facts have not changed and our support has not changed."

Charlton H. Lyons, president, Mid-Continent Oil and Gas Association, in a statement disavowing responsibility of his association for the letter of Texas Republican National Committeeman H. J. Porter soliciting funds at a Houston dinner honoring Rep. Joe Martin.

Labor force squeeze ahead

"Our labor force in the next 20 years will increase at a rate far below that of a soaring population and of the demand for additional goods and services. To maintain our rate of national growth, we are going to have to increase our productivity per worker by almost two-thirds, and the problem will be much harder if the work week is reduced. That means better machines, and more and better technicians, engineers and scientists to design, build, maintain, and run them.

"As our technology improves and becomes more complex, the need for trained people inevitably rises. In the year I was born (1902) industry em-

Delta DC-7's link the oil fields of CUBA and VENEZUELA

with non-stop service between
HAVANA-CARACAS
one-stop service between
NEW ORLEANS-CARACAS

Deluxe *Royal Caribe* DC-7 through-planes daily between Chicago and Caracas. Dovetail connections at New Orleans to and from all points in mid-America and the West Coast. Depend upon Delta's *Golden Crown* DC-7's to keep pace with the fast-growing needs of the oil industry.

FLY THE RADAR-EQUIPPED
Royal Caribe
Golden Crown DC-7's and DC-7B's

Through the magic of Radar, your Captain can "see" ahead up to 150 miles, select the smoothest course.

One of America's Pioneer Scheduled Airlines
Delta AIR LINES

Serving 60 cities in the U.S.A. and the Caribbean
General Offices: Atlanta Airport, Atlanta, Georgia

ELLIOTT 2-POLE MOTORS

tailored to pipe line service

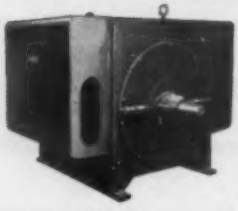
The versatility of ELLIOTT motors solves pipe line pumping problems

More than 40 years ago, Elliott built the *first* large 2-pole induction motor. Since that time, the company has engineered more significant design improvements . . . and sold far more large 2-pole machines, than anyone else. The largest 2-pole induction motors yet built (6000 hp) were designed and built by Elliott.

This engineering background stands behind the Elliott motors described here . . . motors designed especially for *pipe line service*.

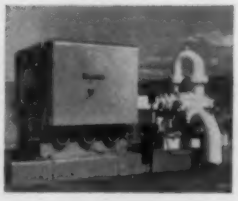
WEATHER-PROTECTED DESIGNS FOR PUMPING STATIONS

- for outdoor locations



Especially designed for outdoor service—not a modified indoor motor. Permits wind-driven rain and snow to blow straight through inlet openings. No housing or enclosure is necessary. Water and dirt positively prevented from reaching motor interior.

- for isolated locations



Where cooling water is unavailable or in short supply, an integrally-lubricated adaptation of the famous Elliott "weather-protected" motor is recommended. The recirculated lubricant is cooled by passage through finned-tube coolers.

SPECIAL MOTOR ENCLOSURES FOR COMPRESSOR STATIONS

- externally-ventilated

Heavily-encased, completely-enclosed, cooled by outside air forced in and out through ventilating ducts. Permits safe operation of motors and compressors in the same room, conserves space.

- inert gas-cooled

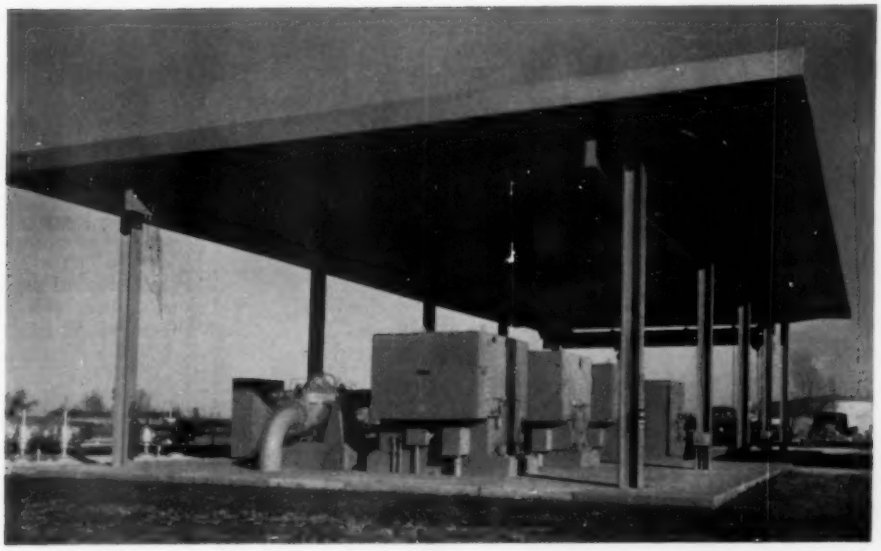
Water-cooled motors with inert gas instead of ambient air circulating over tubular heat exchanger within each motor. The inert gas is introduced at slight pressure to maintain positive pressure within the motor at all times. Eliminates need for expensive explosion-proof enclosures.

Call us about your specific requirements . . .

Take advantage of Elliott's long experience in solving pipe line pumping problems. It pays. Write or call Elliott Company, Ridgway Plant, Ridgway, Pa., today.

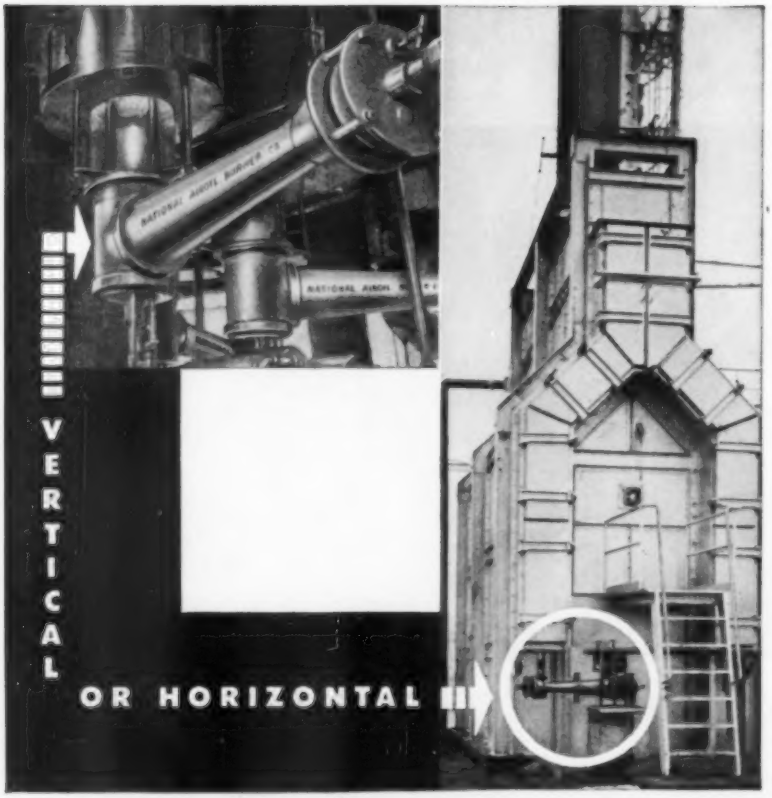
ELLIOTT Company

Four Elliott weather-protected, 2-pole motors serving an outdoor pumping station.



These Elliott base-ventilated, 2-pole motors (all 2500-hp units) are serving a compressor station.

R8-9



many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

NATIONAL AIROIL BURNER CO., INC.

CHEMICAL-PETROLEUM DIVISION

Main Office & Factory: 1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

ployed 1 technically trained employe for every 400 workers. Today the ratio is 1 for every 40 workers, and in some individual companies it is 1 for every 10 to 20. In our atomic power work at Westinghouse, one person out of every five is an engineer of scientist."

John K. Hodnette, executive vice president, Westinghouse Electric Corp., in a speech to the American Institute of Electrical Engineers.

United home front needed

"The industry now finds itself, as in the case of natural gas, increasingly concerned with the passage of corrective legislation.

"To a considerable extent, we are now affirmatively seeking government action—legislative or administrative—not only when such a step is unavoidable, but also in some areas where we should solve our own problems and not seek federal intervention.

"Another factor which greatly complicates the oil industry's governmental relations is the dissension, or lack of unity, within itself . . . All segments of the industry should keep in mind that their fundamental interests are the same.

"Where governmental problems are concerned, effective support, like charity, should begin at home. Yet it is an unfortunate fact that our own employes are usually apathetic about these matters and sometimes through a lack of information even oppose the industry on vital political issues such as percentage depletion.

"This is something you seldom see in other industries. In some other leading industries, for instance, the unions actively oppose legislation that might be harmful to their industries.

"As never before our industry is in a fight for survival, and in that fight we need all the help we can get, and particularly the help of our employes."

Herman P. Pressler, director, Humble Oil & Refining Co., in a speech to the National Employee Information Conference of American Petroleum Institute, Chicago.

Gulf sees no imports threat

"I have not yet encountered anything that convinces me that imports have anywhere nearly reached the levels that might jeopardize the nation's security."

Ralph O. Rhodes, vice president and a director, Gulf Oil Corp., in a speech to the Society of Petroleum Engineers of AIME.

KONTOL

...a proved gasoline plant corrosion preventive

In the gasoline plant, as well as in the refinery, Kontol corrosion inhibitors are preventing thousands of dollars worth of corrosion destruction. Kontol is not an experimental corrosion inhibitor, but has been used successfully in gasoline plants all over the country. In absorption systems less make-up oil is required since Kontol completely rids the system of corrosive products which discolor and contaminate the absorption oil. In addition to its corrosion inhibiting properties, Kontol's anti-fouling and its detergent characteristics serve to keep condensers and heat exchangers free from fouling. In many cases, the savings in cleaning costs even exceed the savings derived from corrosion prevention.

IN THE GASOLINE PLANT
KONTOL
PREVENTS CORROSION IN

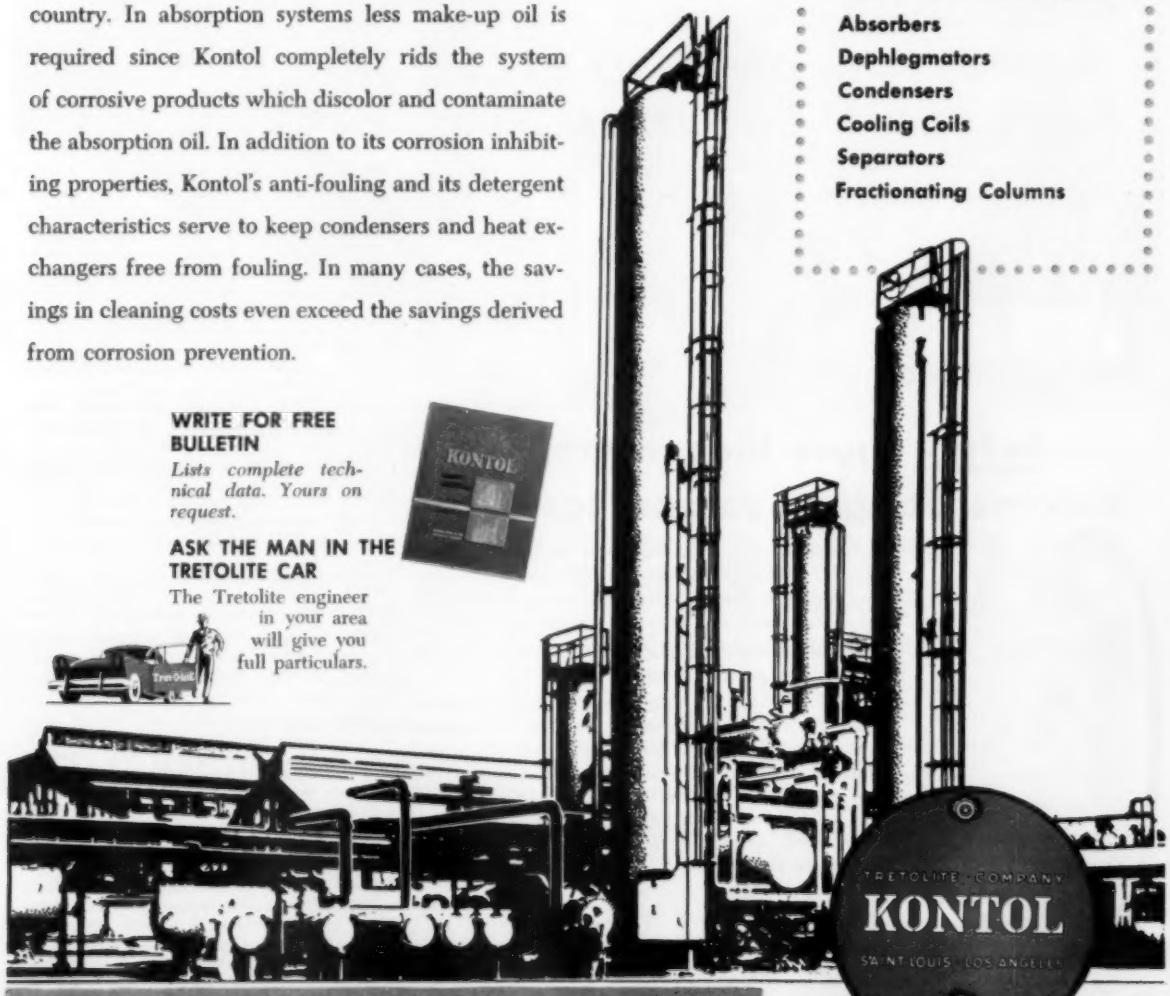
- **Absorbers**
- **Dephlegmators**
- **Condensers**
- **Cooling Coils**
- **Separators**
- **Fractionating Columns**

WRITE FOR FREE BULLETIN

Lists complete technical data. Yours on request.

ASK THE MAN IN THE TRETOLITE CAR

The Tretolite engineer in your area will give you full particulars.



TRETOLITE COMPANY

DIVISIONS OF PETROLITE CORPORATION

369 Marshall Avenue, Saint Louis 19, Missouri

5515 Telegraph Road, Los Angeles 22, California

Chemicals and Services for the Petroleum Industry

DEMULSIFYING, DESALTING, CORROSION PREVENTING, WATER DE-OILING, PARAFFIN REMOVAL, SCALE PREVENTING.

CALENDAR

MARCH

12-14 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Texas, Fort Worth.

13-14 Fifth annual Heat Transfer Conference, Oklahoma State University, Stillwater, Okla.

17-21 International Atomic Exposition, Inc., 1958 Nuclear Congress, Chicago Amphitheatre, Chicago.

17-21 National Association of Corrosion Engineers, annual conference, civic auditorium, San Francisco.

20-21 New England Gas Association, annual meeting, Hotel Statler, Boston.

20-21 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, regional conference on production and reservoir engineering, Mayo Hotel, Tulsa.

23-30 Mexican Association of Petroleum Geologists, Mexico City.

24-26 Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo.

24-26 Western Petroleum Refiners Association, annual meeting, Hilton Hotel, San Antonio, Tex.

26 Petroleum Equipment Suppliers Association, southwestern district meeting, Shamrock-Hilton Hotel, Houston.

27-29 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Southwest conference, St. Francis Hotel, San Francisco.

29 North Texas Oil and Gas Association, annual meeting, Kemp Hotel, Wichita Falls, Tex.

31-April 2 American Petroleum Institute, Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans.

31-April 2 American Institute of Electrical Engineers, southwest district meeting, Mayo Hotel, Tulsa.

APRIL

1-3 University of Oklahoma, fifth annual conference on corrosion control, Extension Study Center, Norman, Okla.

2 Petroleum Equipment Suppliers Association, eastern district meeting, Duquesne Club, Pittsburgh.

8 American Institute of Chemical Engineers, Philadelphia-Wilmington section, University of Pennsylvania, annual meeting, University of Pennsylvania campus, Philadelphia.

9-11 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Biltmore Hotel, Oklahoma City.

13-18 American Chemical Society, national meeting, San Francisco.

15-17 University of Oklahoma, thirty-fourth annual gas measurement short course, North Campus, Norman, Okla.

16-18 Natural Gasoline Association of America, annual convention, Baker and Adolphus Hotels, Dallas.

6-18 National Petroleum Association, fifty-fifth semiannual meeting, Hotel Cleveland, Cleveland.

17 Petroleum Equipment Suppliers Association, Pacific district meeting, Beverly-Hilton Hotel, Los Angeles.

17-18 Texas Technological College, fifth annual West Texas oil lifting short course, Lubbock, Tex.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Louisiana-Arkansas, East Texas, and Mississippi petroleum sections, gas technology symposium, Shreveport, La.

17-18 Geophysical Society of Tulsa, Tulsa Geological Society, annual midwestern exploration meeting, Tulsa.

17-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest regional conference, Spokane, Wash.

20-23 American Institute of Chemical Engineers and Chemical Institute of Canada, chemical engineering division; Canada-U.S. chemical engineering conference, Montreal.

21-23 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Cosmopolitan Hotel, Denver.

23-25 Second International Williston Basin Symposium, sponsored by Saskatchewan Geological Society and North Dakota Geological Society, Regina.

27-30 American Association of Petroleum Geologists, Rocky Mountain section, Casper, Wyo.

28-29 University of Oklahoma, third annual conference on automatic control in the petroleum and chemical industries, Oklahoma Memorial Union Building, Norman, Okla.

28-29 Independent Petroleum Association of America, mid-year meeting, Sherman Hotel, Chicago.

28-30 Southern Gas Association, annual convention, Dallas.

On ungrounded 440 v. 3-phase systems
THIS ELECTRONIC DEVICE
GIVES YOU AUDIO-VISUAL....
WARNING

....before those hidden grounds become dangerous and costly!

By warning of trouble before it becomes serious, the DELTA-DESCO GROUND ALERT saves in many ways. Saves expensive motor rewinding, switch gear and transformers, and prevents crippling shut-downs.

At the same time it reduces the possibility of fire hazards and personnel injury.

HOW IT WORKS! When ground resistance drops to 7,500 ohms in any phase of the 440 V. 3-phase ungrounded circuit, the *green light goes off*, a bell inside the instrument starts to ring and the *red light comes on*. The bell continues to ring until switched off and the red light burns until the ground is corrected. As long as all phases are ground-free the green light burns. Available in portable or stationary model.

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Electronic
GROUND ALERT

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-TODAY!

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Delta Engineering Sales Co.
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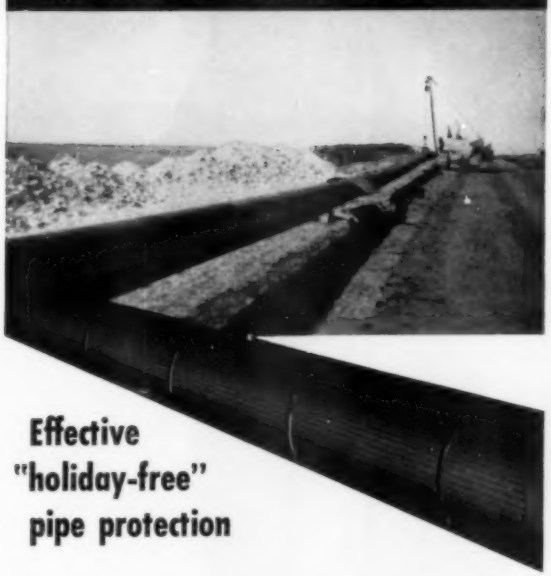
SEALTIGHT® PIPE SHIELD

. . . The practical answer to PERMANENT PROTECTION against all ROCK DAMAGE!



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Sealtight Pipe Shield provides an easily workable protective shield for pipes in every type of terrain or installation. It is the one completely effective and economical answer to "holiday-free" pipe shielding . . . eliminates the expense of dirt padding. Penetration tests show that even large rocks fail to rupture this material. Ideal for protecting pipe sections pulled across swamps . . . replaces ineffective, costly wooden slats or snow fence materials in shielding coated pipes at river crossings and under river clamps. Sealtight Pipe Shield is impervious to stress and strain of soil movements—unaffected by soil chemicals and moisture. Records of on the job tests prove Sealtight Pipe Shield far more effective and less costly than ditch padding installations.

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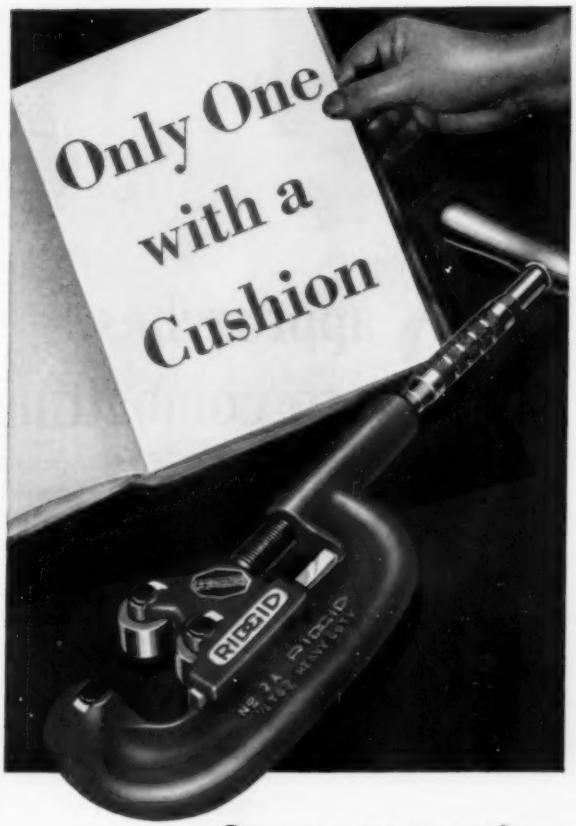
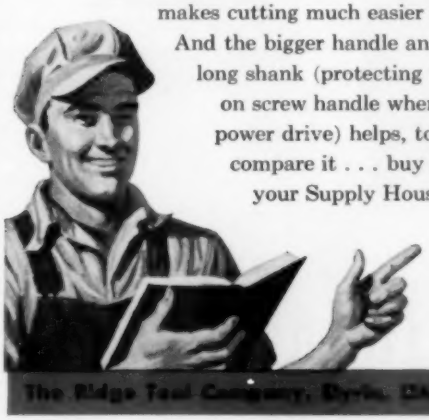


So you get easier quicker action with

New RIDGID Heavy-Duty Pipe Cutters

The instant you start feeding in this new cutter on a pipe you feel the remarkable difference, the new cushioning effect that makes cutting much easier and faster. And the bigger handle and extra long shank (protecting threads on screw handle when you use a power drive) helps, too. Try it, compare it . . . buy it at your Supply House.



The Ridge Tool Company, Elyria, Ohio, U. S. A.

5 approaches to combatting lost circulation

For every lost circulation problem... in drilling, in cementing... into weak or porous formations, fissures or vugs... it's reassuring to know Halliburton is standing by to help you with five basic approaches and sixteen specific remedies... using the industry's leading line of cementing tools wherever needed.

No other well service organization offers you this complete arsenal of powerful weapons against all types of lost circulation. For every circulation loss problem, time-tested Halliburton tools and techniques help you find the answer!

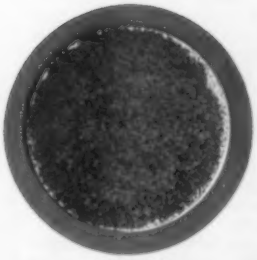
HALLIBURTON
OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

open hole treating packer pinpoints lost circulation zones

The Open Hole Treating Packer can be used to pinpoint the zone of lost returns. It can be set, moved and re-set as many times as may be necessary during a single trip into the hole.

When the zone is located, the blocking agent may be put into place with the same packer. The hydraulically actuated hold-down will confine any tendency for upward motion on the part of the packer.

The drag springs, mechanical slips, packer and hydraulic slips are especially designed for open-hole conditions and provide sufficient over-travel to compensate for normally-encountered deviations from drilled hole-size. The packer element is of the expanding shoe type which has been proven through long usage. The Open Hole Treating Packer is completely independent of the distance from the bottom of the hole, and requires no anchor to bottom.



TUF-PLUG

DV MULTIPLE STAGE CEMENTER

Primary Cementing in Multiple Stages Lessens Weight on Weak Formations

In medium to deep wells with weak formations that may "take" cement, try forestalling trouble by cementing in two or three stages with a Halliburton "DV" (Differential Valve) Multiple Stage Cementer! This ingenious, reliable tool lets you place more than one stage of cement outside the same string of casing. Of great value in reducing weight of cement column on formation, without expense of running extra strings.

"There is no substitute for experience in oil well cementing"

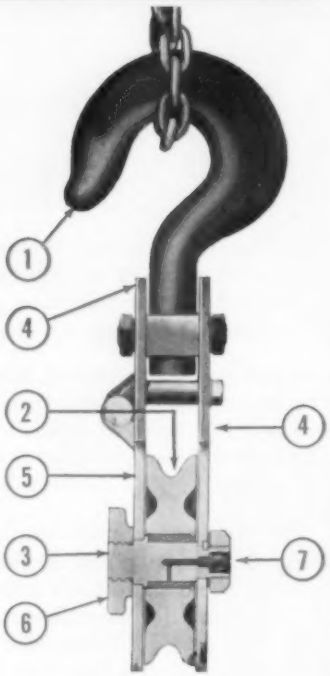
HALLIBURTON
CEMENTING SERVICES

284 SERVICE CENTERS – JUST MINUTES AWAY FROM YOUR WELL

7 features that mean
SUPERIOR SERVICE
LONGER LIFE

WECO®

DROP SIDE SNATCH BLOCKS



25 TON CAPACITY
SIZES: 6", 8", & 10"

1. Drop-forged, heat-treated hook has 100,000 lb. capacity.
2. Forged steel sheave is precision machined and accurately gaged, assuring longer life for sheave and rope.
3. Extra heavy sheave pin and bearing for greater strength, smoother running.
4. ⅜" steel plate resists distortion.
5. Drop-Side (patented) is hinged for easier handling and stringing.
6. Wing nut, tightened or loosened with hammer, holds drop-side in place.
7. Zerk fitting for sheave pin lubrication.

To string or unstring, you remove wing nut, lift side, insert or remove line, drop the side and replace nut. Sheave cannot come off while side plate is raised.

8-1-58

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of **CHIKSAN COMPANY** *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

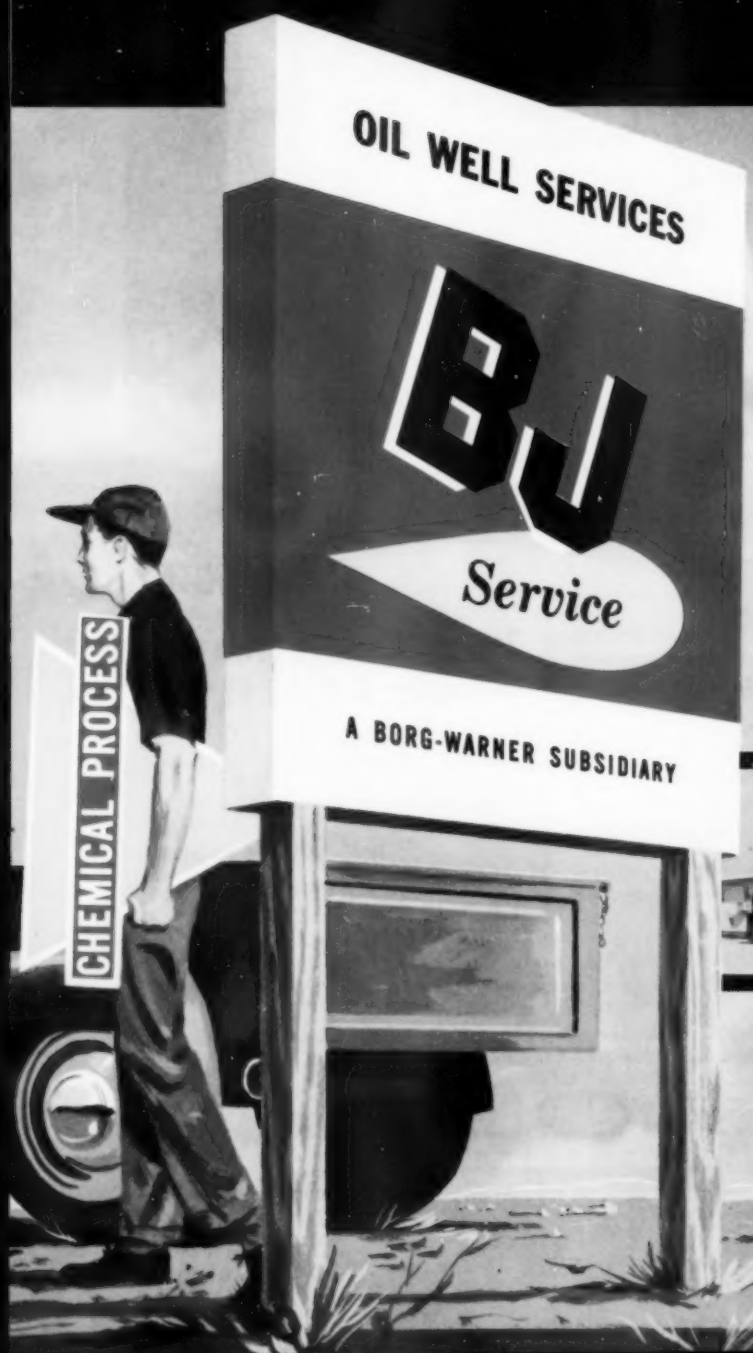
fmc

29-May
1 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, annual joint meeting, Adolphus Hotel, Dallas.

MAY
5-6 Society of Petroleum Engineers of AIME, North Texas section, secondary-recovery symposium, Wichita Falls, Tex.
5-7 Purdue University, thirteenth annual industrial waste conference, Purdue Memorial Union Building, Lafayette, Ind.
5-9 American Gas Association, distribution, production, and transmission conference, Roosevelt and Commodore Hotels, New York.
7-9 American Petroleum Institute, Division of Production, eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio.
8-9 Texas Petroleum Research Committee, eleventh oil recovery conference, symposium on "A Century of Texas Oil, 1875-1975," University of Texas, Austin.
11-14 Texas Independent Producers and Royalty Owners Association, annual membership meeting, San Antonio, Tex.
12-14 Chemical Institute of Canada, National Research Council, eighth Canadian high polymer forum, Macdonald College, St. Anne de Bellevue, Quebec.
12-14 Instrument Society of America, symposium of analysis instrumentation division, Shamrock Hilton Hotel, Houston.
12-15 American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.
20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.
21-23 Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.
21-23 American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.
22-23 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.
26-28 Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.

JUNE
2-4 Petroleum Electric Power Association annual meeting Texas Hotel, Fort Worth.
5-7 National Oil Scouts and Landmen's Association, annual meeting, Mayo Hotel, Tulsa.
8-11 American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.
10-12 Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.
19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.
22-28 American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, Boston.
23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.
28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

CHEMICAL PROCESS ADOPTS BJ SERVICE NAME



A NEW SIGN OF PROGRESS FOR THE OIL INDUSTRY...

A NEW SIGN IS going up on all Chemical Process stations. The blue and yellow emblem of BJ Service has been adopted... replacing the well-known triangle that for 26 years has stood for scientific advancement in chemical treatment of oil wells.

The new BJ Service sign means broader services and expanded technical research for the oil industry. The benefits of Chemical Process know-how in acidizing, fracturing and special chemical treatment are now extended to the Pacific Coast and Rocky Mountain regions. At the same time, the cementing knowledge and equipment of BJ Service are introduced to new fields in the Mid-Continent and Gulf Coast areas.

The unified organization now includes 60 field stations in 11 states, 800 units of specialized mobile equipment and a staff of more than 900.

Yes, the blue and yellow BJ emblem is a new "sign of progress" for the oil industry... with your old Chemical Process friends continuing to offer the extra personal service you've always counted on.

New high-power BJ Service twin pumping unit manifolded for acidizing, fracturing or cementing.

BJ SERVICE, INC.

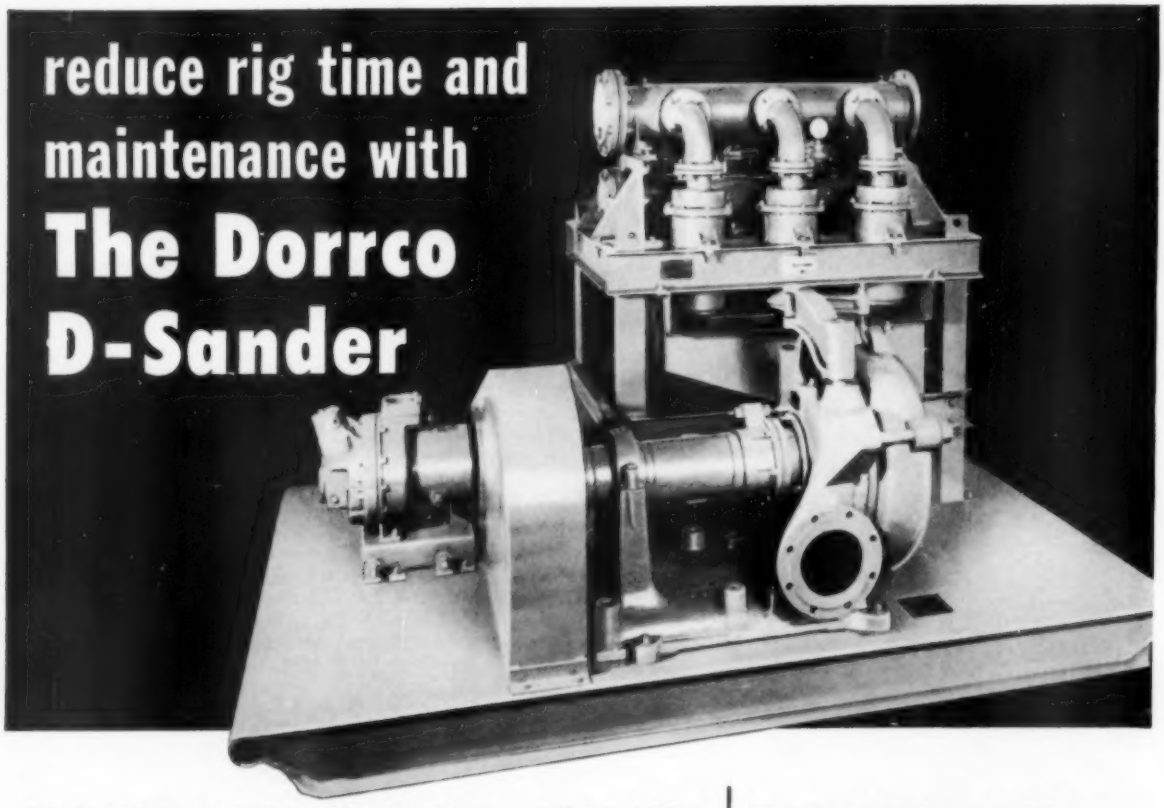
A Borg-Warner Subsidiary

LONG BEACH, CALIFORNIA • FT. WORTH, TEXAS

Stations throughout Mid-Continent, Gulf Coast, Rocky Mountain and California areas

RIG OPERATORS...

reduce rig time and maintenance with The Dorrco D-Sander



The best answer yet to the problem of sand accumulation in drilling muds, the Dorrco D-Sander provides a means for continuous removal of abrasives, returning to the mud pump a low-solids mud containing less than 0.2% API sands.

To the rig operator . . . this may readily be interpreted in big dollar savings on . . .

Surface equipment — slush-pump maintenance costs are drastically reduced . . . tank cleaning for removal of sands and solids is practically eliminated.

Bit performance — is extended considerably with a corresponding reduction in the number of round trips, longer R.O.B.

Actual rig cost savings shown are drawn from a Gulf Coast operation, figures are based on six comparative wells in same field.

Typical Savings with D-Sander 0-9500 Ft.

Actual rig time saved

rotating	45 hrs.	
round trips	8	
downtime cleaning tanks	4	
	57 hrs. at $62.50	**$3,562.50**

Actual equipment savings

2-9⅞" bits at $250.00	$500.00
Mud pump parts	1,400.00
Surface mud equip. (est.)	250.00
Total Savings per well	**$5,712.50**

For more information on the Dorrco D-Sander contact our U. S. Sales Representative, Salt Water Control Inc., 1211 Fort Worth National Bank Building, Fort Worth 2, Texas.

D-Sander T.M. Reg. U.S. Pat. Off.

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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING

Too late to change

THERE'S AN OLD SAYING around the Journal, "There comes a time when you've got to go to press with what you've got."

Obviously no editor is fond of quoting it. Those who deal in news want to get in everything, each last detail, even if it means living dangerously with the mechanical department and the U.S. mails.

But it means, quite simply, you can't deliver the magazine until you print it. And you can't print it unless the editors turn loose of their prose. So there comes a time now and then when the type must be set, even though we know that before the magazine reaches the reader something may happen to change what's been written.

This issue is an example. On page 153 is an article by Henry Lippitt II, of Southern California Gas Co., and what happened to Mr. Lippitt should never happen to an author, but sometimes does.

Mr. Lippitt is bemoaning the fact that every time a gas company thinks it has found a way to escape FPC control, the courts overrule the company and uphold the FPC.

As an example of some hope still remaining for gas producers, he cites the "Saturn case" pending before the Supreme Court.

But in many of our special issues, some pages must be printed early. There's just too much material to wait until the last minute. This was the case with Mr. Lippitt's article.

Then just after the press run on that "form" had been completed, we got a telegram from Mr. Lippitt. "Yesterday Supreme Court denied certiorari in Saturn case. Suggest you revise last sentence on page 2 of my manuscript to read: 'On March 3 Saturn's petition, however, was denied, thus closing that avenue of hope'." Revision was impossible.

Even so, Mr. Lippitt offers the most succinct review available today of where the producer and pipeline stand under federal regulation.

It's one of a dozen exclusive articles in this special issue designed to bring you right up to snuff on the gas business.

Journal editors are convinced that in spite of the great postwar boom in natural gas, its significance still isn't properly appreciated.

Did you know, for example, that:

. . . **We've found more gas** and gas liquids than crude oil since World War II?

. . . **We've increased production** of gas and gas liquids since 1945 almost as much as crude oil and imports combined?

. . . **Natural gas now supplies** 55 per cent as much energy as all petroleum products?

Our figures expert, Economist John Casper, prepared a series of charts to dramatize these facts. They open the special two-color section on page 107.

There are several firsts in this big special, too. There's the first widely published analysis showing how the price of gas is affected by distance from market, volume of reserves, quality, and other factors.

There's the first report on field test of welding pipe with a 20° bevel. And there's a report on the first gas line powered by engine-driven centrifugals at all downstream stations.

Cost cutting comes in for attention, too: How to save money with a unitized-drive system, how to save fuel and increase horsepower by reducing piping surge and valve losses.

And there's a section on solving special problems, such as predicting pressure drop in two-phase pipelines in hilly terrain, and handling large slugs of liquids in an offshore gathering system.

The pipeliner also can go back to school the easy way with a 10-page section covering all the new developments and methods reported during the past year.

The natural-gas industry is certainly dynamic, as Casper's charts prove. And it is always changing. But we'll assure you that, except for Mr. Lippitt's prose, you can read everything in the 55-page section and be confident you're right up to date. Unless, alas, something happens after this column goes to press.

Gene Kinney

when you must be SURE

...that a zone, or a section of casing is positively isolated, set a...

BAKER BRIDGE PLUG

- Easily run and set on wire line, tubing or drill pipe
- Ample clearance for fast, safe running-in
- Sets quickly and holds positively
- Provides positive, leak-proof seal
- Cast Iron for permanence
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- Shorter body and segmented slips drill up quickly and easily
- Always set promptly and accurately by leading wire line service companies.

BAKER WIRE LINE BRIDGE PLUG PRODUCT NO. 400-N

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A chance to clean up a messy reporting job

FOR THE FIRST TIME since states began regulating oil, somebody is trying to put some system into the hodgepodge of reports the industry must file.

The Topsy-like growth of these reports has created an expensive burden on oil companies. And, more important, it has indirectly encouraged sloppy and inaccurate filing of production information.

The Interstate Oil Compact Commission, working through a special subcommittee, has tackled the problem and come up with a recommended set of standardized report forms that ought to be adopted in every oil and gas-producing state.

The Journal brings you up to date on the status of this project in a story this week (p. 84).

The regulatory bodies themselves must decide whether identical report forms will be adopted throughout the oil country. But the burden of selling the idea lies with the industry itself.

Without some push from oil men, the state agencies will feel little compulsion to change their traditional ways of doing business. And why should they? If these forms are going to be adopted by only one or two states, the project will serve no purpose. Its value lies in the prospect that most, or all, states will participate.

THE BIG ADVANTAGE of the standardized forms is that the oil man will know what is expected of him in every state. While the number of required reports may vary from state to state, the information asked on each report will always be the same.

The second big advantage is that carbon copies of the standard forms can be used for the company's own records. This simplifies filing and saves the time now used in transferring data from one form to another.

The third big advantage is that the system eliminates unnecessary drilling reports now required in some states.

THIS PROJECT of standardizing report forms is not so monumental that we're going to lose sleep over it if it fails. Win or lose, the project won't stabilize the price of crude, settle the import issue, or help to pass the Harris bill.

But, whimsey aside, there is no earthly reason why the oil industry shouldn't eliminate waste and inefficiency wherever we find it—whether the job is sinking a well, laying a pipeline, or typing a report.

This project, if successful, will save the industry some money and paper work, help to put its cluttered house in order, and provide still another argument that the Statehouse, not the White House, is the best place to regulate oil.

The Compact subcommittee has completed its job. The forms are ready for use. Now the oil men themselves must spend the time and exert the effort to put this project across.

Hydraulic Torque Converter Drive
Weight — 78,250-lb tractor and side boom with full counterweight
127,000-lb lifting capacity at 4-ft overhang

Here the two HD-21's are lowering the heavy concrete-weighted pipe into a trench at the river bank. Outstanding stability of tractor plus quick, easy control of side boom and counterweights, permits booming out big loads smoothly, safely.

HD-21's handled the big lift on a Trans-Canadian river crossing

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

Two Allis-Chalmers HD-21 tractors with Tractomotive side booms handled the big lifts for Marine Pipeline and Dredging Ltd. on the Red River crossing for Trans-Canada Pipe Lines Ltd. The job involved handling 2,017 ft of 34-in. dia. concrete-weighted pipe weighing 1,200 lb per foot. The two HD-21's lifted section by section of pipe and traveled with it while a machine on the opposite bank pulled the pipe across the river.

Marine Pipeline President, Glen Kennedy, stated, "These HD-21's not only lift the big loads, they can run with them, too. They've really got the capacity and balance to handle the heavy pipe."

The tractor-side boom units, together with other spread equipment, worked a 70-hour week on this job. Operators particularly liked the way the HD-21 handled under heavy loads and the easy, positive control of the side boom.

Allis-Chalmers-Tractomotive offers three tractor side boom sizes to fit your pipe-line requirements. Choose the most modern pipeline equipment available today — see your Allis-Chalmers construction machinery dealer.

TRACTOMOTIVE CORPORATION, DEERFIELD, ILLINOIS

TRACTOMOTIVE

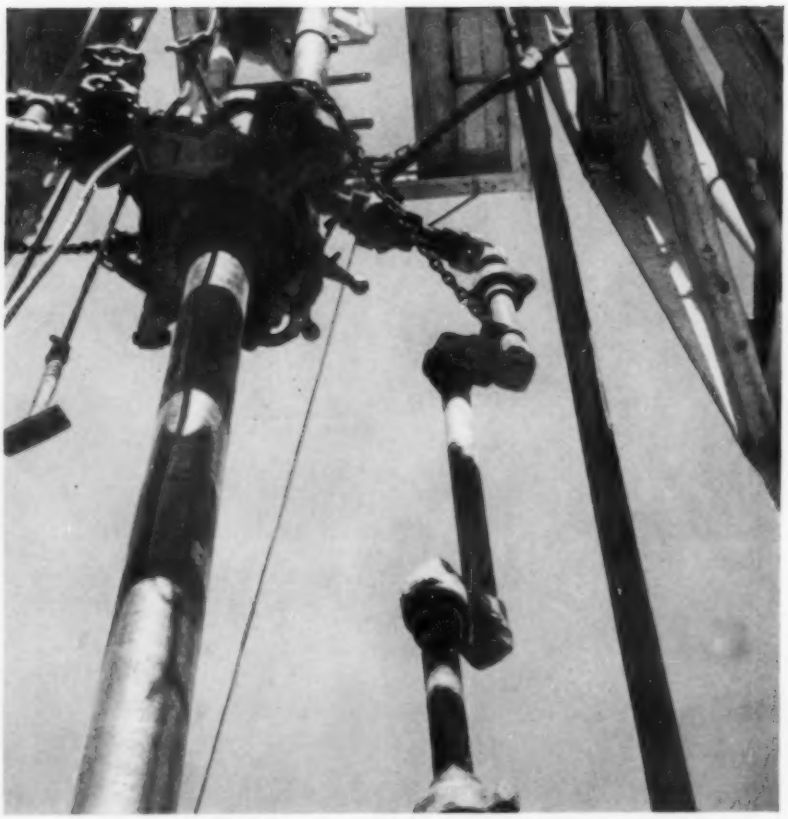
Cement your well with DIACEL

When you need a low-density cement, use DIACEL D, with or without the low-water-loss additive, DIACEL LWL.

Saves cement! The correct DIACEL system can save up to ¾ the cement previously required and give you better all around performance at the same time.

DIACEL LWL provides flexible cement retardation to fit your requirements. It allows you to place cement to extreme depths and at a wide range of temperature . . . gives you a low-water-loss slurry that helps prevent pipe sticking, flash setting and water damage to pay zone formations.

*A trademark



IT'S EASIER TO MAKE A WELL WITH CEMENTS BASED ON DIACEL*

You can tailor your cement system to fit various exacting requirements with Diacel cement additives. Intermediate string cementing? Pay zone? Squeeze jobs? Whatever your cementing operation, there is a Diacel system that will do the job efficiently and economically.

For practical solutions to your cementing problems, call your Diacel field engineer. Or consult your Diacel Technical Handbook for information to determine thickening time and compressive strengths of slurries at various temperatures, as well as other important data to help you formulate the best cement system for each particular job. Write for your free copy today, or obtain it from your cement service company.

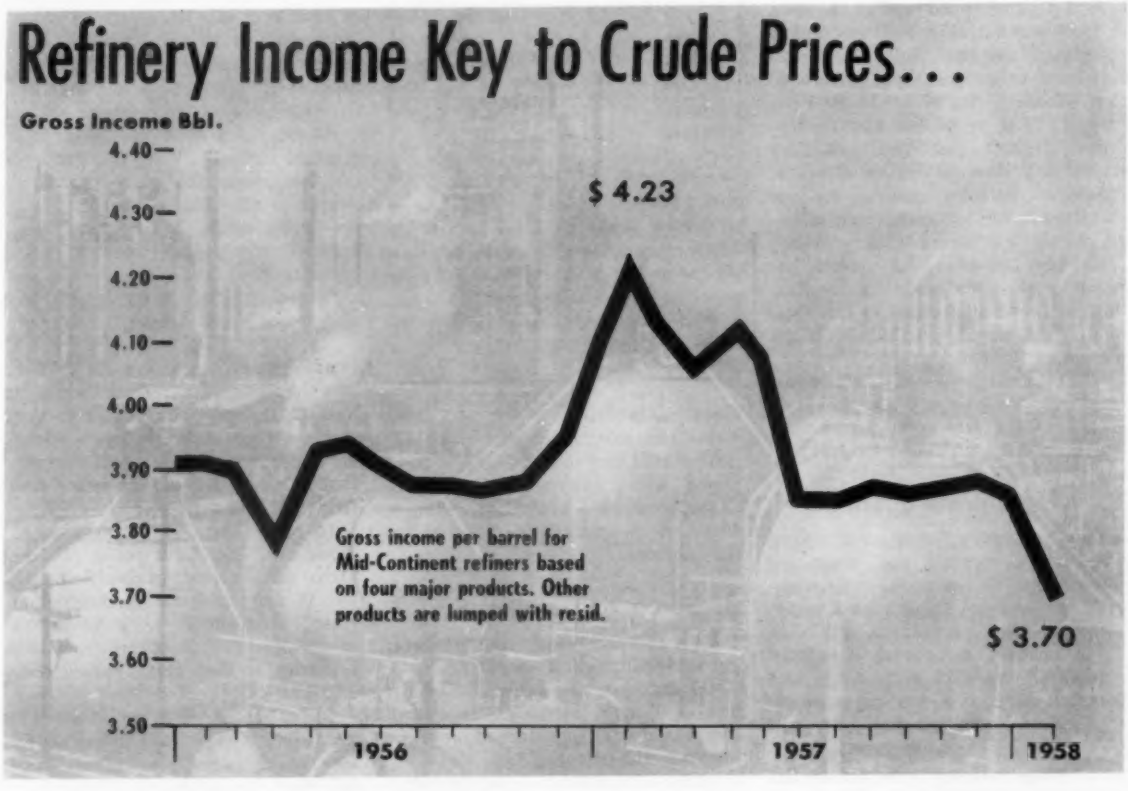
DIACEL

DRILLING SPECIALTIES COMPANY

Bartlesville, Oklahoma

the OIL AND GAS JOURNAL

March 10, 1958



Next 2 Months Critical For Industry

If refiners fail to halt the serious decline in their per barrel plant realizations, crude prices must give. Most oil men, however, still are optimistic recent allowable and refinery cutbacks will stabilize both the crude and products markets.

THE GENERAL crude-price structure appears safe for the moment.

The real test on prices will come in the spring. Between now and then is a critical hold-the-line period.

This view is widely held by both major and smaller independent refiners who provide a market for the nation's oil.

These men assess the industry situation like this:

Necessary immediate steps have been taken to cure a domestic petroleum oversupply. All the prorated states have cut back March production by about 550,000 bbl. daily. Refiners have announced cutbacks in runs to stills totaling nearly 300,000 bbl. daily.

Whether these moves will accomplish their goal of bringing crude and product stocks closer to a balance with demand depends on two big "ifs":

... **Imports** are held constant at present levels.

... **Producers and refiners** are willing to continue their sacrifices through March and April.

By May, demand for gasoline should be gaining speed with the planting season in full swing and the motoring season starting. With a little luck in the weather to nudge both activities the industry should surmount its present crisis.

1. Refining is the key

Actually, whether the industry can pull out of the present crisis without a general crude price cut will depend on what happens to refinery realizations.

The profits pinch refiners have suf-

fered the last few months brought on the spate of price adjustments which threatened the entire crude-price structure.

The graph (p. 81) shows clearly what happened to refinery income. In the Mid-Continent area, refiners averaged $4.23 a barrel income from their refined products in February 1957. This dropped rather steadily to $3.70 per barrel in February 1958.

Refiners on the Gulf Coast experienced an even sharper profit decline—from a top of $4.24 in February 1957 to $3.69 last month. Refiners on both the West and East coasts went through similar wringers.

Several industry sources believe that most refineries, particularly coastal plants, are losing money today.

Refiners estimate the spread between crude price and total realization at the plant is down to less than 80 cents a barrel. One even puts the margin at 50 cents.

Their only recourse is to cut costs, and the price of the crude they buy is one of the few spots where they can economize quickly.

2. Why there's optimism

One executive of a major company with broad refining and producing interests in this country says emphatically he does not think such a crude price cut now is imminent.

He believes the recent slowdown action will stabilize both crude and product prices if a four-point policy is continued through the first half of the year. His requirements:

... **Keep refinery runs** under 7.4 million barrels daily.

... **Hold imports** to present levels.

... **Keep crude** production low.

... **Give domestic demand** for the four principal products an increase of 2½ per cent in the second quarter over the same period last year.

"If all four of these requirements are met, by the middle of June there should be some profit back in refining," he says. With the refiner recovering, the outlook will improve for the crude producer.

An executive of another major domestic producer and refiner says the slowdown should stabilize product prices first, and this will react favorably on crude prices.

He sees no further cuts in crude prices but concedes this estimate depends on what happens to imports. If movement of foreign oil picks up in this country, price cuts are almost inevitable, he thinks.

Other oil men interviewed by Journal editors expressed similar cautious but optimistic views. A few independent buyers, however, feel some areas in Oklahoma, North and West Texas still may face some price adjustments if they are to continue competing with cheaper crudes in the Chicago market. They agree, though, that prices generally are safe for the moment.

CITIES SERVICE

40 and above	3.02	—	
40-44.9	—	3.08	
45-45.9	—	3.06	
46-46.9	—	3.04	
47-47.9	—	3.02	
48-48.9	—	3.00	
49-49.9	—	2.98	
50-50.9	—	2.96	
51-51.9	—	2.94	
52-52.9	—	2.92	
53-53.9	—	2.90	
54-54.9	—	2.88	
55 and above	—	2.86	

NEW TREND in crude buying is shown in posting above by Cities Service Oil Co. for condensate in areas of New Mexico and West Texas. Note the price penalties put on higher gravities which have fallen into disfavor among refiners (OGJ, Feb. 10, p. 66).

3. Some explanations

How did the refiner and producer get into this plight anyway?

Oil economists agree the basic answer is the tremendous capacity of the world oil industry to produce above world demand.

They believe oversupply may be a sporadic problem which the industry will have to learn to live with for several years. On the long term world demand is expected to catch up and solve the problems.

This situation poses a chronic problem for the domestic oil producer.

Price cuts don't help . . . But even with present voluntary restrictions on imports, the domestic producers' problems aren't all solved. He can overproduce the crude market that is left. This overproduction softens his crude prices.

But cheaper prices for oil, unlike many other commodities, won't increase the demand. They just mean the oil producer is wasting his assets by selling them often lower than it will cost him to find new oil. Producing only to meet expected demand is his solution.

The refiner faces a similar situation. In cost cases he has a modern plant that is so complex and expensive it pays him to operate it as near capacity as possible. He thereby gains greater efficiency and realizes lower unit costs.

One refiner cites costs of present refinery cutbacks as an example of this. He declared that refiners who cut back would lower their plant realizations because their per barrel costs would increase due to lowered runs.

This stems from one big fact: Cost of operating the refinery won't drop in proportion to the cutbacks. The sacrifice, however, is worth the cost because if products prices stabilize, the profit picture will change.

At any rate, multiply this urge to produce at capacity by the hundreds of plants over the country and it's simple to see how refiners can build up excess stocks of products—especially if the demand they expected failed to materialize. Excessive stocks then begin to depress product prices, and this squeezes refinery realizations.

Crude values considered . . . When that happens, the refiner begins to look at the price he pays for crude and the type of crude he is getting. He'll start offering less for the crude that is harder for him to refine profitably.

In many cases of recent scattered crude cuts, the lower prices reflected actual relative value of specific crudes. Others were made to equalize competition. And some were unrealistic, made more to free buyers from commitments so they could reduce refinery runs.

But at this stage, if the oil producer keeps pushing his crude to market and the refiner keeps running his plants full blast, prices all around will break and everyone's in the soup.

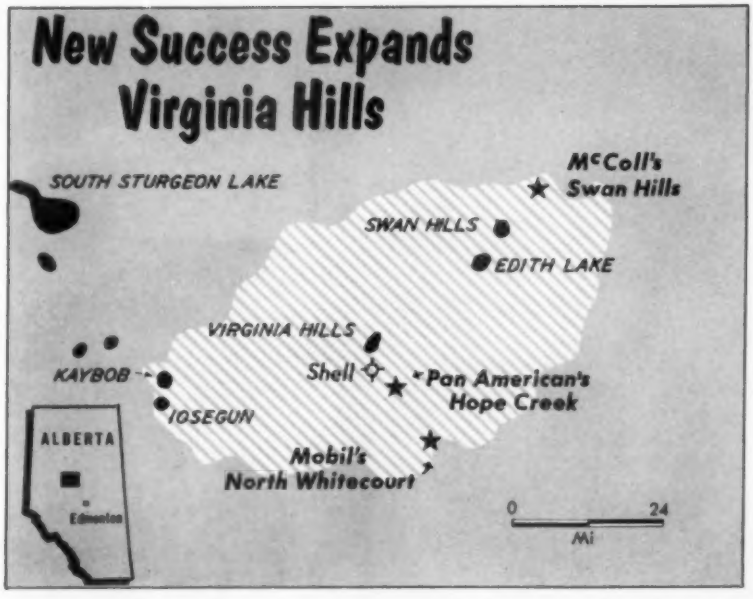
That's a simplified explanation of why producers in prorated states were willing to slash production recently and why refiners have cut back runs.

Both producers and refiners say, however, that so far the cutbacks haven't rescued either from their economic woes. But all believe the solution is to continue keeping production and runs down to prevent stocks from piling up further.

Total stocks of the four major products already have dropped sharply for the fourth straight week. Last week they stood at 26,299,000 bbl. above last year. At the beginning of February they were more than 50 million barrels above last year. February's cold weather nearly halved the excess.

The big hope now is that spring demand will take care of the oversupply and firm prices.

If this fails to develop and product prices continue to fall this spring, then the general crude price structure cannot hold.



Young Field Has 10 Rigs

. . . probing the Beaverhill Lake formation in the muskeg of northern Alberta. Mobil, McColl, Pan Am report shows.

VIRGINIA HILLS, the top discovery area of northern Alberta last year, is fast gaining new prestige for 1958.

It has three new indicated discoveries. And 10 drilling rigs are at work in the expanding 40-mile-long region northwest of Edmonton.

. . . **Mobil Oil of Canada, Ltd.,** has an oil showing from the Beaverhill Lake-Devonian structure with its North Whitecourt No. 8-28-62-12. Drill-stem tests indicate two separate evaluations covering 104 ft. The first gave up 1,968 ft. of oil, mud, and water, and the second produced 7,321 ft. of fluid, which included gassy oil-cut water cushion, brown oil-water emulsion, and salt water.

. . . **McColl-Frontenac Oil Co., Ltd.,** has a showing at its 10-14-69-9 Swan Hills. The well has a 530-ft. Beaverhill Lake sector, but only 124 ft. of that was included in the drill-stem test. A 3-hour test surfaced gas in 90 minutes at a rate too small to measure and gave a pipe recovery of 180 ft. of oil-cut mud, 90 ft. of heavily oil-cut mud, and 105 ft. of clean oil. Drilling has been resumed.

. . . **Pan American Petroleum Corp.** has an indicated success at its 6-36-62-13 Hope Creek in the Beaverhill Lake. The well is located 3½ miles northwest of Mobil's North Whitecourt.

There is one sour note in the Virginia Hills exploratory program. Shell Oil Co.'s 10-17-64-13 Swan Hills was abandoned after first being labeled an indicated discovery.

The well found an oil zone in the Beaverhill Lake, but it turned out to be noncommercial.

Other drilling . . . Six rigs currently are probing virgin territory in the Virginia Hills region, and four others are drilling at follow-ups to discoveries.

Home Oil Co., Ltd., is the principal explorer in the region. Working with United Oils, Ltd., and Geoil, Ltd., the company has four rigs active. Three are development tests, and the other is a 3-mile stepout to production in the Edith Lake region.

Pan American has two rigs working. One is drilling the Hope Creek well, and the other is southeast of Edith Lake.

Shell has one rig in the area (at the 10-17 Swan Hills) and Imperial Oil Co., Ltd., is making hole 10 miles south of the Virginia Hills strike. Both companies found the Beaverhill Lake to be nonproductive, and Imperial is checking deeper horizons.

The other two rigs in the area are those of Mobil and McColl.

How it happened . . . Labeled the most important discovery of 1957 in northern Alberta's remote wildcat country, the Virginia Hills producing area now stretches from beyond Swan Hills on the northeast to Iosegun on the southwest, well over 40 miles. The producing limits are still undefined.

The Home Oil team made the initial strike at 9,300 ft. in the Beaverhill Lake-Middle Devonian formation at Virginia Hills in February 1957. Then it followed it up with discoveries at Swan Hills and Edith Lake, 25 miles to the northeast. The prolific producers in the Beaverhill Lake gave Canada an entirely new pay zone.

Later in 1957, Phillips Petroleum Co. leaped across the muskeg to Kaybob and hit another 4,500-bbl. Beaverhill Lake well at 9,600 ft. Then came California Standard Co.'s discovery at Iosegun River, a few miles to the southwest.

Memphis Review

handed setback. Hearings not likely before October.

THE SUPREME COURT will probably not consider the Memphis case until next October at the earliest.

In a terse one-sentence order, the court last week denied a motion by the Department of Justice to advance the hearing date. The review was requested in December by the Federal Power Commission and several companies.

Solicitor Gen. J. Lee Rankin had asked the court to set arguments for April 28. This would have made possible a decision before the end of the current court term. The next term begins in October.

The Supreme Court had agreed early in February to review the Memphis decision handed down by the District of Columbia Appeals Court. The court held the FPC could not accept a rate-increase application unless all customers of the pipeline had previously agreed to the hike (OGJ, Feb. 10, p. 67).

FPC Chairman Jerome Kuykendall and others have said that obtaining such customer approval is next to impossible, so the decision stands to create havoc within the industry.

In another order last week, the Supreme Court ruled that it will not review a lower court ruling that upheld the FPC's right to regulate natural-gas prices at the wellhead. Saturn Oil & Gas Co. filed the appeal after losing a case before the Tenth Circuit Court of Appeals in Denver.

The Saturn lawsuit was testing whether the Supreme Court, in the Phillips case, intended to place small gas producers under FPC regulation (OGJ, Nov. 25, 1957, p. 69).

THE 8½ X 11 SHEET (left) would become standard for report forms, replacing the odd variety (right). That's what's . . .

Proposed: Uniform Oil Report Forms

Here's a plan of the Interstate Oil Compact to make it easier for oil firms to report drilling and refining activities to state agencies. If the states go along, it means fewer reports, greater accuracy, and money in the bank.

Howard Wilson
Tulsa District Editor

A TIME-SAVING, paper-saving system for standardizing report forms of oil-producing companies is ready for "selling."

If the state regulatory agencies buy it, oil companies will cut their filing costs, simplify their reporting methods, speed their operations through use of machines, and find it easier to meet requirements of the several states they operate in.

The state agencies stand to benefit, too.

With the influential support of the Interstate Oil Compact Commission behind it, the system should get a favorable hearing in most states.

Here is the plan and how it would be put in operation:

. . . **Each regulatory agency** will be asked to adopt a standard set of report forms.

. . . **The forms** cover virtually every type of report a state would want on drilling, production, and purchasing. Some "deadwood" information still sought by states is eliminated, while other information is added.

. . . **The forms** already have been drafted by a committee of the IOCC. Both producers and representatives of the states participated in the work.

The committee devised 32 forms in all. Of this number, 25 are considered necessary for proper regulation of the industry. The other seven are included so that states wanting extra data can use standard forms.

The IOCC approved the forms last December and urged their adoption by the states. The job of selling the idea now falls to the producers themselves and industry associations.

Benefits

The value of uniform report forms cannot be measured in dollars and cents. But even in terms of money one industry spokesman says the system would save the industry at least a half-million dollars a year and probably closer to a million.

Here are some of the advantages to the oil companies:

. . . **With forms standardized** in all states, oil company employes who handle reports for more than one state or who move from one state to another will have their work simplified.

. . . **Carbon copies** of forms used for reporting data to state agencies can be used for the companies' own permanent records without restyling and retyping.

. . . **Use of card report forms** which cannot take carbons will be eliminated.

. . . **The forms** will adapt easily for processing through electrical machines, such as IBM.

. . . **Data will be easy** to find in the offices of all regulatory bodies because of uniformity.

. . . **Reports** which serve no useful purpose will be eliminated.

Help to agencies . . . Advantages of the uniform system do not lie entirely with the companies. The state regu-

latory agencies would benefit. Here's how:

. . . Reports will contain fewer errors because companies will not have to vary the method of presenting similar information from state to state. A company which operates in 20 states now must report the same type of data in 20 different ways.

. . . Many states which are now using outdated report forms plan to modernize them. The proposed system does this job for them without cost.

. . . By adopting a uniform system the states can prove their ability to work together in oil regulation, thus providing another argument against federal control.

The Changes

In drafting the forms, the IOCC committee decided to cut down on the number of drilling reports now required by some states. It eliminated no information but combined all the data into a single well-completion report. This does away with filing numerous reports during drilling.

Here is argument of Committee Chairman O. P. (Pete) Nicola for the combination report: "Some states have an onerous system of applications and reports of work done on many detailed routine operations involving a well being drilled, completed, or recompleted. Practically all of this information, if shown on the final well-completion report, would better serve the requirements of the state authority."

With this in mind, the Nicola committee prepared a comprehensive "Well Completion or Recompletion Report and Well Log." The report contains on a single sheet all the information the regulatory agency would want from the time a drilling permit has been issued until completion.

Another proposed change of importance to the industry standardizes well-potential and gas-oil ratio tests. Since instructions on conducting the tests would be the same for all states, some states would have to change their present testing requirements.

The committee had a tough time deciding whether to include space for notary seals on the forms.

Most oil men deplore the necessity for having forms notarized. One called it a "ridiculous practice" because prosecution for violation of a state notary law is unheard of.

However, some state officials have objected to eliminating the notary requirement. Whether there are prosecutions or not, the officials argue that the requirement helps deter certain people from filing false reports.

(Continued on page 86)

DAN DUNNETT of the Oklahoma Corporation Commission compares a proposed drilling application form with the card system now used in Oklahoma. If the changeover is made, the cards will be abandoned in favor of standard 8½ by 11-in. sheets now used in most other states. The sheets will take carbons and thus save extra typing. The booklet Dunnett holds contains copies of all the model report forms proposed by the Interstate Oil Compact.

Here're the Reports Suggested by IOCC

THE Interstate Oil Compact Commission has recommended 25 basic report forms and another 7 forms as supplementary if required.

Basic Forms

Organization report.
Application for permit to drill, deepen, or plug back.
Bond.
Application for multiple completion and instructions.
Packer-setting report.
Packer-leakage test.
Potential test and request for allowable.
Well completion or recompletion report and well log.
Request for permission to consolidate leases.
Well-status report and gas-oil ratio tests.
Reservoir-pressure report.
Report of injection project.
Plugging record.
Application to dispose of salt water by injection into a porous formation.
Operators' certificate of compliance and authorization to transport oil or gas from lease.
Monthly producers' report.
Certificate for load oil credit and permit to transport recovered load oil.
Gas well open-flow potential test.
Request for gas allowable.
Purchasers' gas nominations.
Producers' report of gas production.
Gas purchasers' monthly report.
Gasoline-plant or pressure-maintenance plant monthly report.
Transporters, storers monthly report.
Refiners' monthly report.

Supplementary Reports

Production test and gas-oil ratio report.
Well status report.
Permit to clean tank.
Gas-well deliverability or shut-in pressure test.
Application to measure gas and liquids off the lease.
Periodic GPM test.
Carbon-black plant report.

(Continued from page 85)

Rather than jeopardize the chances for adoption of the entire system, the committee decided to include space for notary seals. States, at their pleasure, can decide whether notarization is required.

Company Views

One top oil executive who worked on Nicola's committee says he knows of no opposition to the system from the industry itself.

"In redesigning and streamlining the forms, we cut out a lot of deadwood that isn't needed any more," he said. "We found 34 states requiring 77 kinds of reports. We combined a lot of them."

The same executive is particularly happy that the standardized forms have been designed for use with mechanical equipment.

"That goes hand-in-hand with the present trend," he said.

Another member of Nicola's committee, whose firm has production in 15 states, said the project "is one of the finest things the Interstate Oil Compact has put before the industry. This has been a neglected field."

One Agency's View

Regulatory agencies will have to make some sacrifices in adopting the new standardized system. But even the agencies can expect to gain more than they lose.

The Oklahoma Corporation Commission is one state body which would face a major overhaul of its filing system by adopting standardized forms.

But Dan Dunnett, assistant director of the conservation department, says Oklahoma would be willing to make the switch in the interest of uniformity, despite the many changes that would have to be made.

For example, Oklahoma uses a 5 by 8-in. card for some of its reports, principally the Notification of Intention to Drill, Deepen, or Plug Back. It has thousands of such cards in its current files. To adopt the 8½ by 11-in. standard form would mean either keeping double files for an indefinite period or transferring the information on the current files to the new forms.

Another problem, Dunnett points out, is that thousands of blank commission report forms are now in the files of oil companies for future use. These would become obsolete automatically. Past experience has shown that outdated forms continue to be used by the reporting companies for years after new forms are issued.

"We changed our well-record forms 6 or 7 years ago, and we still get some of the old forms in," Dunnett says. "It's hard to change overnight."

Because of the physical problem of printing new forms, setting up new filing systems, and notifying the operators well in advance of the changes, Dunnett says the switch will take considerable time.

The benefits . . . But the advantages of the proposed system outweigh the disadvantages for the regulatory agencies, Dunnett believes. Foremost is the fact that it will help guarantee properly prepared reports. Oil firms operating in a number of states will know what is expected of them everywhere.

Perhaps the biggest advantage to the state agencies is the incentive the new system will give them in putting their own houses in order. Most states have a variety of report forms that have been changed, individually, over the years without any thought of standardizing them as a whole.

An agency may have half a dozen shapes and sizes of forms, each requiring its own type of filing cabinet and special handling.

Forms are flexible . . . Dunnett believes also the regulatory bodies generally can use the standard forms despite differences in reporting rules from state to state.

Oklahoma, for instance, differs from other states in not requiring producers to file a monthly crude-oil production statement. This data, in Oklahoma, is taken from monthly reports of the purchasers. Under the new system, Oklahoma would continue with its present practice and simply not use the recommended form for producers.

In another instance, Oklahoma requires more information on gas-oil ratio tests than the recommended form prescribes. However, the proposed set of forms includes a supplementary report for use by states which want the additional data.

The Oklahoma Corporation Commission currently is making a study of all its field rules and soon will hold hearings on recommendations of its conservation department. Dunnett believes the proposed forms are flexible enough to work satisfactorily with the new rules.

Chairman Ray C. Jones of the Corporation Commission serves also as chairman of the compact's committee on regulatory practices and is

Nicola Directed Report Group

THE MAN most responsible for producing a set of uniform report forms for the oil industry is Phillips Petroleum Co.'s O. P. (Pete) Nicola, Jr. Nicola served as chairman of the industry subcommittee of the Oil Compact's committee on regulatory practices.

Members of the Nicola committee were R. E. Adams, Cities Service Oil Co., Bartlesville; V. D. Arnold, Sinclair Oil & Gas Co., Tulsa; A. R. Ballou, Sun Oil Co., Dallas; John C. Brooks, The Texas Co., Houston; Paul N. Colliston, Continental Oil Co., Houston.

S. F. Holmesly, Humble Oil & Refining Co., Houston; H. C. Lay, Shell Oil Co., Tulsa; P. P. Manion, Jr., Pan American Petroleum Corp., Tulsa; Fred H. Pennington, Magnolia Petroleum Co., Dallas; F. T. Stebbins, Gulf Oil Corp., Tulsa; F. Norman Woodruff, El Paso Natural Gas Co., El Paso; and John H. Zanon, The California Co., New Orleans.

Members of a regulatory agency subcommittee, which reviewed the work of the industry group, were: Olin Culberson, Texas Railroad Commission; Dan Dunnett, Oklahoma Corporation Commission; Ed Albares, Louisiana Department of Conservation; and John Roberts, Kansas Corporation Commission.

O. P. (Pete) Nicola

Ray C. Jones, chairman of the Oklahoma Corporation Commission, is chairman of the IOCC's committee on regulatory practices, which approved the subcommittee's report.

familiar with the project to standardize forms.

"Oklahoma hopes to go along," Jones said. "We're certainly in favor of the idea."

Who's Behind It

Many oil companies are promoting the uniform report plan. Most interested are the companies which furnished members on the committee that prepared the final report adopted by the Oil Compact.

The driving force behind the committee's work has been its chairman, Pete Nicola, director of proration in the production department of Phillips Petroleum Co. at Bartlesville. Nicola's position with Phillips puts him in constant touch with many state regulatory agencies, and he has long been active in the effort to improve reporting practices by companies.

It was Nicola who proposed to the IOCC in 1955 that an industry committee, working under the committee on regulatory practices, be named to draft a set of forms.

Nicola's proposal was the first on the subject since 1946, when a committee composed of representatives of state regulatory agencies undertook the job of standardizing forms. This group prepared 11 forms, which the regulatory practices committee approved.

But these forms were only partially adopted by the individual states and failed to achieve the purpose intended.

Different approach . . . The new committee headed by Nicola was formed as an industry group, representing 13 companies. It held three meetings before submitting its report to the parent committee in December 1956. Then, last June, a companion committee composed of four representatives of the state regulatory bodies was named to review the work of Nicola's group.

Finally, last December, the full committee on regulatory practices and the IOCC itself approved the plan for uniform forms and urged its adoption by the states.

Executive Secretary Earl Foster of the IOCC estimates that more than 1,000 man-hours of work went into the project.

"We believe these forms represent the best thinking of both the regulatory authorities and the industry," Foster says.

The Job Ahead

Now that the spadework is completed, the question is simply this: Will the states adopt the forms?

It will take a selling job that won't be easy. Converting from one set of forms to another will cost some money, and the filing system of each state agency must be altered. Clerks and other personnel will have to be re-educated.

Some states won't like the forms because they omit information now required. Others will object because the forms require too much information. Getting agreement among more than 30 oil-producing states may be impossible.

But if a half-dozen of the biggest oil states adopt the forms, the battle will be three-quarters won. This would standardize most of the paper work for most companies.

Nicola says the work of his committee is finished—and now it's up to the oil companies and their associations to carry the torch to the states.

F. H. Rhees, a vice president of Sinclair Oil & Gas Co. has written to 26 industry associations soliciting their support for the plan in their respective states. And L. E. Fitzjarrald, manager of Phillips' production department, is writing similar letters to a number of oil companies.

If these and other efforts bring the industry solidly behind the plan, adoption by the states should come more easily.

And if state agencies have the same sympathetic attitude that Oklahoma has, the oil industry some day should save a lot of time, paper, and money.

New Drilling Record

for Los Angeles County may be set by Sunray wildcat.

SUNRAY Mid-Continent Oil Co. is preparing to drill an 18,000-ft. test in Newhall-Potrero field north of San Fernando Valley in Los Angeles County. This will be the deepest hole in Los Angeles County if it goes to anywhere near its programed depth.

The present Los Angeles County record holder is Shell Oil Co.'s 48-A Alamitos in Long Beach field which reached a total depth of 14,950 ft.

Location of Sunray's prospective record-setting, 147 RSF, is 2,000 ft. northeast of Newhall-Potrero field.

There have been only two holes drilled below 18,000 ft. in California. Both reigned as the world's deepest holes at the time they were drilled. One was Ohio Oil Co.'s 21,482-ft. test in Paloma field, Kern County, drilled and abandoned in 1955. The other was Superior Oil Co.'s 18,734-ft. 1 Limoneira in the North Montalvo area of Ventura County, which was drilled and abandoned in 1949.

—— *Industry* briefs

American Natural Gas Co., Detroit, has formed a new exploration and producing subsidiary called American Natural Gas Production Co. Pipeline subsidiaries of the parent company include American Louisiana Pipe Line Co., Michigan Wisconsin Pipe Line Co., and Michigan Consolidated Gas Co.

The Kansas Corporation Commission ordered a 9 per cent reduction in crude-oil allowables for March. This cuts production to 310,000 bbl. daily, or 31,000 bbl. below the February figure. Water-flood areas were exempted from the order.

California's huge Wilmington oil field is two steps nearer unitization and a proposed 1,000,000-bbl.-daily flood.

Long Beach voters last week approved 37,902 to 22,522 a charter amendment permitting the city to enter into life-of-the-field unit agreements. Previously the city was limited to only 25 years. Wilmington operators were reluctant to enter into unit agreements with Long Beach because of the restriction.

On the same day last week, a bill was introduced into the state legislature which would provide for either voluntary or compulsory unitization of fields where subsidence was occurring. This measure is aimed at paving the way for the 1,000,000-bbl. flood in the field.

The Texas Co. has launched its 46,-000-ton Trinidad, largest ship ever built at the Sparrows Point, Md., shipyards of Bethlehem Steel Co. The tanker is the first of three in this class which Bethlehem is building for Texaco. The Trinidad is almost 50 per cent larger than any other ship launched at Sparrows Point.

Southern Minerals Corp. has cut 10 cents per barrel from its Southwest Texas postings for select crudes. They were consolidated with light gravity Sweden prices which top at $3.35 for 40°-gravity and above. About 12,000 bbl. of crude daily in Nueces and San Patricio counties are involved.

Puchaser proration is coming and going. Esso Standard Oil Co. has cut its purchases of crude in Louisiana to 75 per cent of March allowables and in Mississippi to 80 per cent of February levels. Cities Service Oil Co., meanwhile, is resuming normal purchasing in Texas, Louisiana, and New Mexico in March following allowable cuts in those states.

Production-Sharing Plan

. . . outlined by OCAW. Employers would pay "royalties" to workers by contributing to special investment fund.

A STOCK-investment trust is a key feature of the novel royalty plan which the Oil, Chemical, and Atomic Workers International Union is considering as a means of cutting its 200,000 members in for a share of industry production.

Additional details of the proposal were disclosed after the union's 52-member bargaining-policy committee established 1958 negotiation goals designed to "stabilize employment and wages" (OGJ, Mar. 3, p. 63). The program is mandatory for 105,000 members employed in oil and related industries.

The committee gave preliminary consideration to the royalty plan and directed OCAW President O. A. Knight to draft details for the next committee meeting. No date for the meeting was announced.

The policy group proposed that each employer pay a small royalty on each physical unit of production into a central fund to be administered jointly by OCAW and management.

Payments made into the fund would be apportioned to the individual accounts of workers turning out the production on which the royalties were paid.

The money would be invested in a carefully selected portfolio of securities, an idea borrowed from widespread operation of mutual investment trusts for small investors.

The investments of each individual OCAW worker would remain his sole property, or that of his heirs, but provision would be made for withdrawal of the funds only for limited purposes. These would include:

. . . **College or technical school** tuition for a young man or woman.

. . . **Costs of catastrophic illness,** beyond that covered by insurance.

. . . **Supplementary severance,** disability, or retirement pay, and supplementary benefit for a widow or other dependents.

. . . **Capital** for entering private business.

The committee said the royalty plan could not be negotiated on an industry-wide basis at the present. The group said it would be practical to establish such a plan with participation of only a few companies or bargaining units with periodic expansion to additional bargaining units.

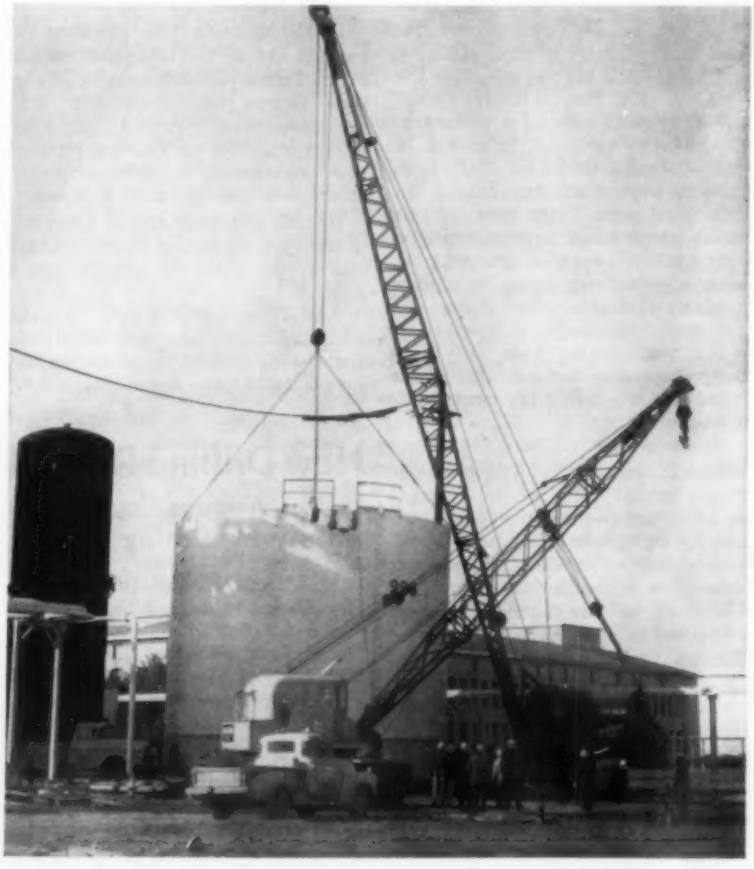
Severance pay . . . Also disclosed were more details of a mandatory 1958 bargaining goal of "substantial" severance pay for employes laid off.

A contract clause to be demanded will stipulate that such pay can be based upon either the laid-off employe's current basic weekly wage, or his average basic weekly earning rate during the 24 months preceding termination, whichever the worker selects.

The amount of severance allowance was left for the present to the discretion of the local bargaining unit.

Ultimately, however, OCAW said it will demand an additional contract provision under which employes laid off would receive 2 weeks' pay for each year of service with a company, plus an extra age allowance. This allowance would be computed by increasing the amount of severance pay by 10 per cent each year of age beyond 40 up to a maximum of an additional 200 per cent.

Wage demands this year will be geared to the increase in the cost of living, plus an increase of 3½ per cent annually "to compensate for the increased productivity of the American economy as a whole."



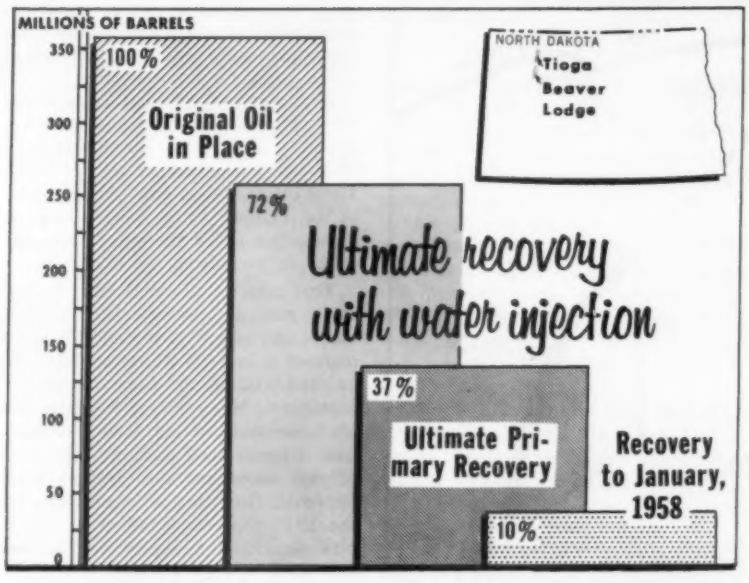
Esso "Walks" A Tank to New Location

MOVING DAY at the tank farm calls for ingenuity.

Some tanks are floated to new locations. Some are skidded on greased rails. Others are dismantled and rebuilt.

Less frequently, tanks are moved in easy stages by cranes. At Esso Standard Oil Co.'s Baton Rouge refinery, the crane method was used to move a 40-ton tank (photo). A smaller crane laid stepping stones of wooden mat ahead of the large crane, which picked up the tank and swung it by stages to its new location.

The tank-moving job was the biggest ever tried at the nation's largest refinery.



126 bbl. for each $7 spent is the promising outlook as . . .

Big North Dakota Unit Sought

Amerada, 20 others hope to nearly double recovery from Tioga, Beaver Lodge fields with $7-million injection plan.

THE WILLISTON BASIN may soon get its first major pressure-maintenance program.

Amerada Petroleum Corp. and 20 other operators hope to nearly double ultimate recovery by injecting water into the Madison lime in North Dakota's Tioga and Beaver Lodge fields. The program would encompass 40,436 acres.

The project will get under way after the North Dakota Industrial Commission gives its approval and after the 1,800 royalty owners are approached. Hearings started at Bismarck last week. Unitization of the two pools would be the first ever authorized by the state.

A study shows that an estimated 132,000,000 bbl. could be recovered through primary means (chart). But water injection would push ultimate recovery to as much as 258,000,000 bbl. This is about 72 per cent of the estimated 358,000,000 bbl. of original oil in place.

The two 6-year-old fields had produced 35,300,000 bbl. up to January 1—only about 10 per cent of the original oil in place. The wells are currently allowed to produce 48 bbl. per day, but only three-fourths of them are able to make allowables.

Spurred by declining bottom-hole pressures and increased gas-oil ratios and water production, unitization plans began nearly 20 months ago. Reserve figures are based on an extensive study by Keplinger & Wanenmacher, Tulsa petroleum engineers.

The plan . . . The two projects combined will involve 458 wells, drilled on an 80-acre pattern. Only the Madison will be affected. Amerada, which owns 86.5 per cent of Beaver Lodge and 84.4 per cent of Tioga, would be operator of the two separate programs. Hunt Oil Co. is the second principal owner and M. B. Rudman, the third.

It will be several months before actual injection begins. The operators plan to inject water at the edges of the fields, pushing the oil toward the center.

Company engineers estimate that at peak injection, not expected for several years, 93,000 bbl. of water daily will be required for about 40 injection wells. About 60 per cent of this will go to Tioga, the rest to Beaver Lodge. Injection water will come from sands at about 4,800 ft., supplemented by produced water.

Tioga . . . Madison production began at Tioga in 1952. The field had produced 18,200,000 bbl. as of January 1. Another estimated 53,000,000 bbl. could be produced through primary means.

Pressure maintenance is expected to boost ultimate recovery to as much as 155,100,000 bbl., or 72 per cent of the estimated 216,000,000 bbl. of original oil in place.

Original bottom-hole pressure at Tioga was 3,695 psi. This had dropped to 2,598 psi. by last fall. Meantime, gas-oil ratios climbed from 1,000 to 1,663. About 65 of the 265 producing wells have ratios exceeding 2,000.

Water production averages about 23 per cent, and about 100 of the wells are on the pump. Interstitial water saturation is 34 per cent. Gross thickness of the Madison pay averages 56 ft., and porosity is 7 per cent.

Beaver Lodge . . . This field, just south of Tioga, is the site of the first oil discovery in North Dakota—the 1 Clarence Iverson, which found oil in the Silurian on a drill-stem test in April 1951. The hole was plugged back, and Madison production began later that year.

The Madison at Beaver Lodge had yielded 17,100,000 bbl. as of January 1. Ultimate primary recovery is estimated at 60,800,000 bbl. Water injection would push ultimate recovery to 102,900,000 bbl. Original oil in place is estimated at 142,000,000 bbl.

The unit area takes in 193 wells on 16,987 acres. Water production averages 27 per cent and 56 of the wells are on the pump. Interstitial water saturation is 42 per cent. Pay thickness averages 86 ft., and average porosity is 5.09 per cent.

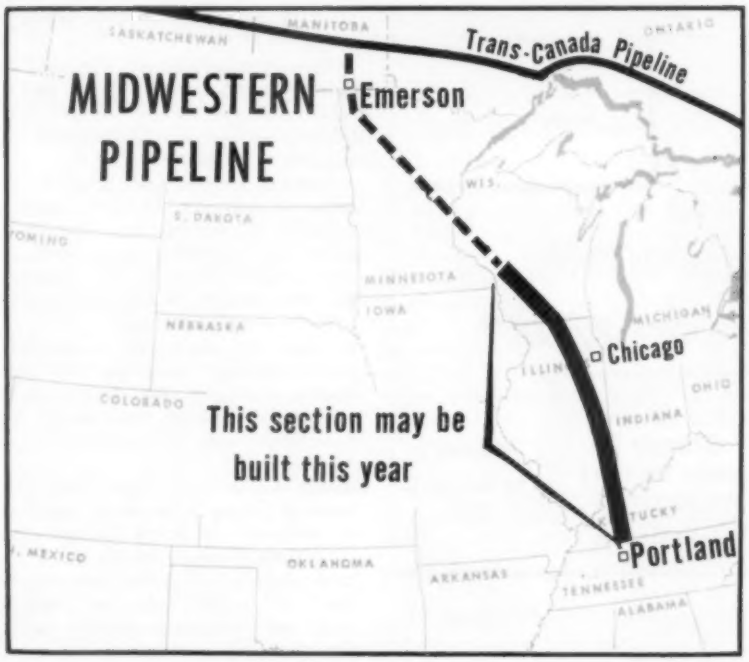
Gas-oil ratio climbed from 1,100 to 1,736 by last fall. Now there are 73 wells with gas-oil ratios exceeding 2,000. Original bottom-hole pressure was 3,821 psi. This dropped to 2,717 psi. by last fall.

Production from both pools totaled 548,000 bbl. in December. Peak production was 965,000 bbl. during January 1956. Allowables have declined since mid-1956 because of development of other nearby pools.

The 42°-gravity oil produced at the two pools is pipelined to the 31,600-bbl. Standard Oil Co. (Ind.) refinery at Mandan about 140 miles away.

Deeper production . . . Water will be injected only into the Madison. But recently Amerada has been busy drilling deeper at Beaver Lodge.

Successes include new producers in the Devonian found below 10,000 ft. and the Silurian found below 11,000 ft. These are expected to spur deep exploration in other fields of the Nesson anticline, extending north and south of Beaver Lodge (OGJ, Dec. 23, 1957, p. 36).



Midwestern Gets Break

. . . when opposition to southern section of pipeline folds. With approval of FPC, line could be built by next winter.

THE BITTERLY contested Midwestern Gas Transmission Co. project from Portland, Tenn., to Emerson, Man., has taken a sudden and drastic turn with the withdrawal of opposition by a Chicago utility.

The surprise action by Peoples Gas Light & Coke Co. may clear the way for early approval by the Federal Power Commission and construction of the southern portion of the 2,000-mile system this year. The northern section, based on imported gas from Trans-Canada Pipe Lines, Ltd., is still opposed by Northern Natural Gas Co. and American Natural Gas Co.

Now, instead of a continued FPC and court battle over a "market raid" by Midwestern, a Tennessee Gas Transmission Co. affiliate, there is the possibility of gas deliveries through the new line next winter. FPC cooperation to expedite the case is implied in the agreement.

Here are the purchase commitments to Midwestern worked out in secret Washington meetings arranged by the governor of Illinois and the Illinois Commerce Commission:

. . . Peoples, 45,000 M.c.f. daily, provided Midwestern assigns to Peoples its contract to sell gas to U. S. Steel Corp. in Chicago. Peoples also agreed to purchase additional volumes from Midwestern should gas be available next winter.

. . . Northern Indiana Public Service Co., 100,000 M.c.f. daily. Northern Indiana also would take over Midwestern contracts to supply Indiana steel companies.

. . . Northern Illinois Gas Co., 50,000 M.c.f. daily.

Other companies agreed to purchase lesser volumes, raising the commitments to Midwestern to more than 200,000 M.c.f. daily. The deals are subject to clearance by the Department of Justice, which has been investigating the Midwest market hassle for antimonopoly law violation.

Squeeze play . . . From the beginning, Peoples had refused to buy gas from Midwestern. And it fought Midwestern's proposed service to industrial customers in its area. It argued such service would be harmful to Chicago domestic consumers.

Peoples' opposition was a vital factor in Midwestern plan because, lacking adequate storage, a gas line must rely on industrial customers to balance its load. The industrial load can be interrupted or reduced on cold winter days when space-heating demand requires all or most of the pipeline capacity. Peoples was reluctant to concede this industrial load, which is indispensable to high load-factor, low-cost operation, and makes possible lower prices for home heating.

With a long legal fight in prospect, attempts were made at compromise to bring all major opponents into Midwestern as equal partners of TGT. These efforts failed and were dropped at the behest of the Justice Department when a federal grand jury was called to investigate the matter.

The case was further complicated by a new and unexpected development—the Memphis decision. Peoples planned to increase deliveries this year by 485,000 M.c.f. daily through a subsidiary, Natural Gas Pipeline Co. of America. But the Memphis decision requires prior customer approval of rate increases, and, without such approval, financing is impossible. So the 1958 program, scuttled by Memphis decision, had to be rescheduled for 1959.

Since Midwestern is a new system with rate agreement written into original contracts, it was not faced with the Memphis problem.

Peoples was in the unhappy position of being unable to supply immediately, some dissatisfied customers in its market area and, at the same time, facing a competitor which claimed it could.

Meanwhile, pressure for a settlement mounted. Governor Stratton and the Illinois Commerce Commission had been working for some time to clear the way for quickly expanded service to the Midwest area. And Peoples, at the urging of state officials, finally dropped its opposition to Midwestern.

With an assist from the Memphis decision, Tennessee Gas appears to have gained an important victory for at least the southern half of the proposed system. When Peoples threw in the towel, Midwestern got more than it had been able to contract for in the way of markets in the Chicago-Gary area. Midwestern not only has the green light to serve industrial markets but an opening into residential markets as well.

As a result, the southern portion of the line, if it is approved, likely will have a capacity exceeding the 200,000 M.c.f. daily originally planned.

What's next . . . It was not clear last week whether the new agreement would require an amended filing by Midwestern or whether the FPC could approve only a part of the pending application and allow early construction to Chicago.

Midwestern officials made it clear they are prepared to start construction

on the line in the near future if given the official go-ahead. The agreement reached at the Washington meetings, at which Midwestern was represented, was based on the assumption that Midwestern could get additional gas to Chicago for the 1958-59 heating season.

Gas for the new Midwest markets would come from TGT reserves in Texas and Louisiana. It would move through TGT's main transmission system to a point near Portland, Tenn., origin of the Midwestern line, and then through Kentucky, Indiana, Illinois, and Wisconsin.

Terminus of the line, if the southern section is built first, has not been announced. But it's expected that the line could be built as far north as central Wisconsin, the planned meeting point of Gulf Coast and Canadian gas.

Canadian imports . . . N. W. Freeman, Midwestern president, emphasized that the agreement with Peoples does not mean Midwestern will abandon its proposal to build the northern part of the line from Canada.

This leg would start at the point the proposed 1958 construction ends and extend north through Wisconsin and Minnesota to the international boundary near Emerson, Man. Initially, 200,000 M.c.f. of gas daily was to move south from Canada, with an equal volume moving north.

To get this project going Midwestern not only must overcome continuing strong opposition of Northern Natural and American Natural, but also must cope with the uncertainty of Canadian supplies for which it contracted from Trans-Canada. The Borden Commission of Canada has completed hearings on Canadian gas reserves and in a few months is due to report on whether the country has any surplus available for export.

FPC completed hearings January 31 on the Midwestern application. In the normal course of events a decision could be expected this autumn, but the FPC could, if it chose, decide earlier on the southern portion of the line because it does not relate to Canadian gas.

The Portland-Emerson line would cost approximately $111 million and consist of some 2,067 miles of pipeline. The main line would range in diameter from 12 to 24 in.

Canadian Gas Policy Awaiting Elections

CANADA'S BORDEN Commission has completed its natural-gas hearings but is expected to wait until after the upcoming federal elections before releasing an interim report recommending a gas policy for the nation.

Should the elections go against the Progressive Conservatives, the commission probably will die quickly. Lester Pearson, leader of the opposing Liberal party, has called the commission an unnecessary burden.

Pearson has stated during his stumping tour that if the Liberals are returned to power, his government will not hesitate to promote gas exports.

As it stands now, the Borden Commission has stated it will release an interim report, but the timing has been left in the air. The report is considered important because Prime Minister Diefenbaker has said the Conservatives would base their export policy on it.

THE MEN who are making Canadian gas policy take testimony at Calgary.

The hearings . . . During the windup of the commission hearings at Calgary, British American Oil Co. submitted its estimates of Canadian gas reserves and said exports should be geared to potential growth of reserves —not solely to proven reserves.

"It is unrealistic to ignore potential growth," BA said. "In our opinion the policy that will best serve the national interest is one permitting the immediate export of quantities (of gas) determined to be surplus to the foreseeable needs of Canada."

BA estimated that a drilling program of 1,000 exploratory wells per year would produce marketable gas reserves of 134 trillion cubic feet by 1982. But the company emphasized that available export markets are needed to provide the incentive for this type of development.

Canada at present is increasing its reserves at the rate of 2.3 trillion cubic feet per year and will need to increase this to only 4.4 trillion by 1965 and keep it at this level to reach the predicted 134-trillion reserve figure, BA said.

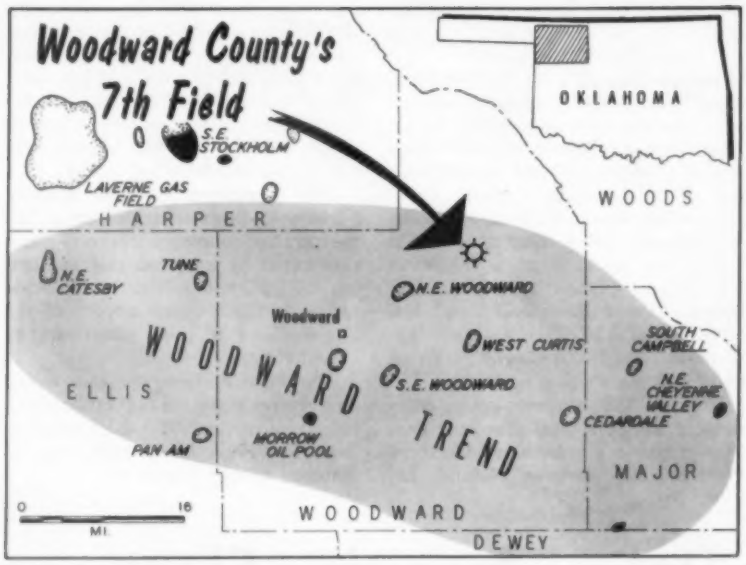
If this is done, the company said Canada will have four times as much gas during the next 25 years as will be required to meet the total needs of Canada and the presently authorized exports to the U. S.

But that is not all the story. BA contended that the 134 trillion reserve will be far short of the nation's grand total of reserves. Geological studies, BA said, put the ultimate virgin reserves for the Western Canada sedimentary basin at 308 trillion.

The petroleum industry has reached a "critical stage," BA said.

"Expenditures in oil and gas properties over the past 10 years have been $3.2 billion, but the return to date has been only $1.9 billion," the company said. "Of that total income from production, gas has contributed only 3.4 per cent.

"The prospect of export markets would provide the necessary stimulus to develop existing reserves and to discover new reserves."



Oklahoma's New Gas Success

. . . is developing in northwestern area centering around Woodward County. Other counties also sharing in play.

FOURTEEN MONTHS AGO Woodward County in northwestern Oklahoma had no production and not much promise of any. Today it has seven fields.

The seventh pre-Permian field came in early this month. Calvert Drilling Co. found Morrow gas at its 1 Young, 15 miles northeast of the city of Woodward.

The county's success story began in December 1956, when Union Oil Co. surprised northwestern Anadarko basin wildcatters with a gas discovery southeast of the city of Woodward at 1 McCormick. Initial production was 25,000 M.c.f. of gas per day and 15.5 bbl. of distillate per 1,000,000 cu. ft.

Union's discovery—Southeast Woodward field—set off one of the most extensive production hunts in the short oil and gas history of northwestern Oklahoma, exclusive of the panhandle. Wildcatters staked wells in every nook and cranny of the county and splashed over into Dewey, Ellis, Major, Harper, and Woods counties.

In Woodward County further successes came quickly. Five other fields were opened — Woodward Townsite, Northeast Woodward, West Curtis, Cedardale, and the Morrow oil pool. All are gas except the Morrow.

The 1 Young, which opened the new Northeast Woodward field, flowed 2,000 M.c.f. per day before acid treatment. The operator will test again after acidization.

The initial discovery at Southeast Woodward back in 1956 stirred exploration in neighboring counties, and in 1957 three new pools were opened in dormant Ellis County to the west. Ellis had seen production several years ago at South Salon only to die on the vine later.

The new Ellis pools are Morrow gas producers — Northeast Catesby (five wells and a sixth on the way), Tune (two wells), and a Pan American Petroleum Corp. discovery near the southwest corner of Woodward County.

Late last year western Major County, east of Woodward County and seat of famous Ringwood field, got into the act with a new wildcat territory opened at South Campbell, a gas field, and Northeast Cheyenne Valley, an oil field.

All this pre-Permian success lies in an area called by many the "Woodward Trend." This is an entirely new oil and gas province for Oklahoma.

The Woodward County discoveries have unleashed a wave of large-block leasing across northwestern Oklahoma roughly parallel to the Canadian River. Land prices jumped last summer in a swath from Harper County on the northwest to Kingfisher County on the southeast.

The Woodward trend is a long southeastern projection of the prolific success in Harper and Beaver counties of the past few years. It extends nearly 100 miles northwest-southeast. Two dozen wildcats are digging in the trend, and all will have an important bearing on the future of this new northeastern shelf province of the famed Anadarko basin.

Thus Woodward County is fast taking its place among the big producing counties of northwest Oklahoma —Beaver, Harper, Texas. And next will be Ellis, Dewey, and Major.

Company May Sell

oil properties. Midstates involved in possible deal.

MIDDLE STATES Petroleum Corp. is considering the merger or sale of the company and its principal producing subsidiary, Midstates Oil Corp., Tulsa.

In a report to stockholders, directors of Middle States said the firm of Dillon, Read & Co., Inc., has been retained to assist in a possible transaction.

Officers of the company indicated that certain companies have expressed interest in a merger or sale, but the names of the companies were not disclosed. P. C. Dixon is president of both Middle States and Midstates.

Middle States' most recent annual report showed net daily crude production of 8,442 bbl. in 1956 and daily gas production of 42,392 M.c.f. Properties are located in Kansas, Oklahoma, Mississippi, Louisiana, Texas, New Mexico, and Canada.

The company's productive leases in the U. S. at that time totaled 95,616 acres, and in Canada 1,760 acres. Total undeveloped acreage totaled 1,604,507. Consolidated net income in 1956 was $1,034,094.

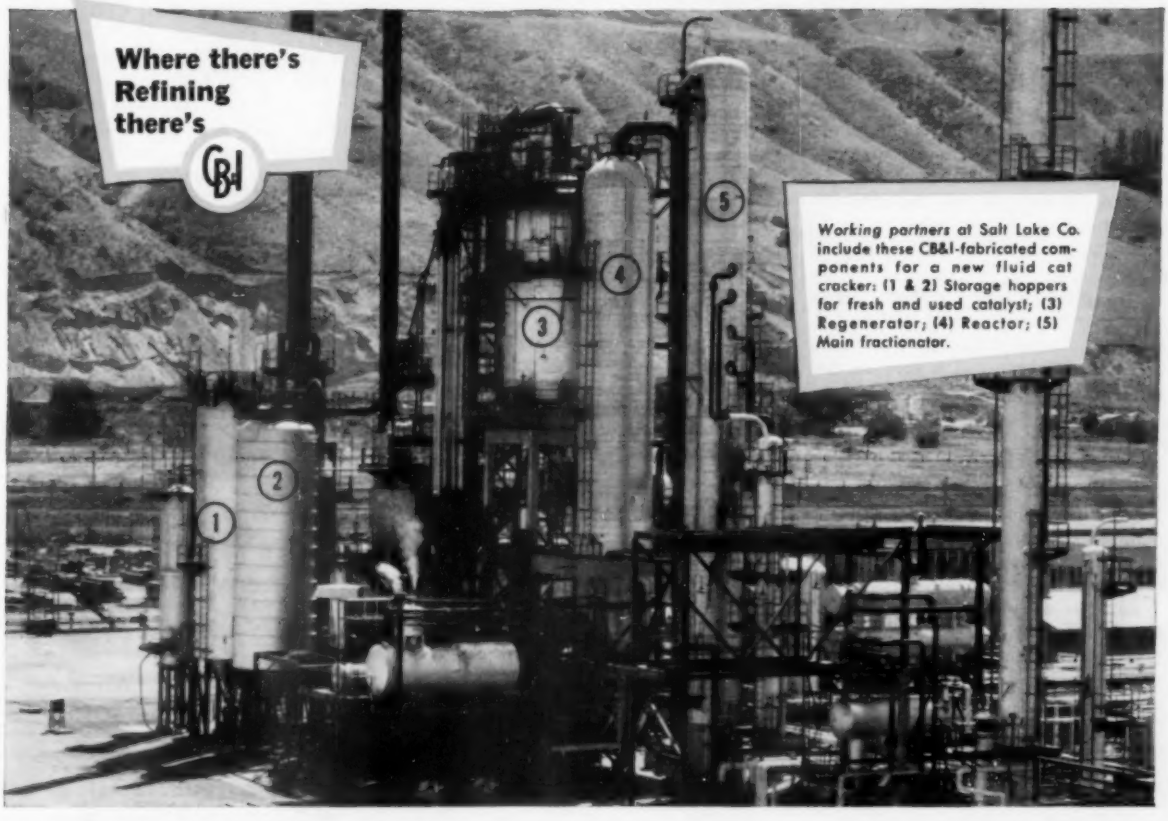
Kermac Order Draws Fire

CONTROVERSY between Northeastern Oklahoma oil producers and Kerr-McGee Oil Industries, Inc., is continuing over Kermac's move to charge producers for gathering.

Some producers have notified Kermac they will not accept the division order amendment containing the 15-cent gathering charge (OGJ, Feb. 24, p. 82). Others also contend they actually are being charged to move Kermac's oil.

Kerr-McGee, for its part, announced that refusal to accept the charge will cancel the division order and leave the producers without a buyer. It has not cut off any producers yet, however. Kerr-McGee also has resumed buying truck oil and has decided not to shut down a small crude line in Tulsa County.

CB&I Structures serve 3 fold Refinery Expansion


Where there's Refining there's CB&I
Working partners at Salt Lake Co. include these CB&I-fabricated components for a new fluid cat cracker: (1 & 2) Storage hoppers for fresh and used catalyst; (3) Regenerator; (4) Reactor; (5) Main fractionator.
1
2
3
4
5

New "Cat" Cracker boosts Salt Lake Refining Company gasoline output by 20%.

Included in a recent expansion program of the Salt Lake Refining Company were CB&I-fabricated storage hoppers, regenerator, reactor and fractionator for the new fluid catalytic cracking unit show above.

The building of additional Horton® Floating Roof tanks now brings Salt Lake's storage capacity to more than 1,600,000 barrels.

In refineries *everywhere* you'll find CB&I storage and processing vessels designed, fabricated and erected for operation under a wide range of vacuum, pressure and temperature conditions. These CB&I "working partners" are all built under the most rigid standards of craftsmanship to provide the petroleum industry with structures that meet their constant demand for progress and perfection.

Yes, when *you* plan refinery expansion you can plan with confidence—in the experience and facilities provided by CB&I *craftsmanship in steel.* Write our nearest office for details.

CB&I Structures were furnished through Fluor Corporation.

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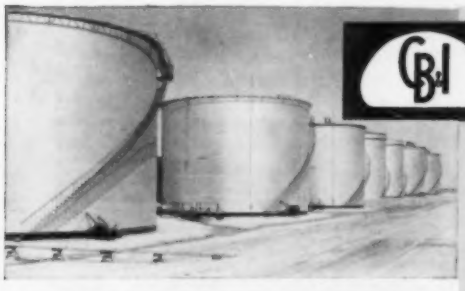

Among the storage vessels at the Salt Lake Refinery are 63 CB&I-built storage tanks. Above: Horton® Double Deck Floating Roof tanks.

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SUBSIDIARIES:
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Import Policy Forming

. . . but cabinet group holds off decision. Officials want to keep voluntary plan, while producers want quotas in law.

THE CABINET imports committee apparently will wait until late this month to recommend a course of action on oil imports, but the committee's thinking already appears to be crystallizing on a number of vital points.

The policy-forming group, whose recommendation probably will be followed by President Eisenhower, failed to reach agreement at a meeting last week.

However, a person close to the committee said the committee is leaning toward these views:

. . . **It wants** to avoid mandatory controls in any program it recommends. The committee hopes to head off the drive in Congress for mandatory quotas on crude oil and products.

. . . **It is considering** ways to crack down forcefully on one or a few importers who violate their voluntary quotas—but without cracking down on all importers.

. . . **Its main concern** is the total crude imports it will allow for the program starting July 1. The total is likely to be no more, and may even be less, than now allowed.

. . . **It probably** will give "new" importers some quotas and, if so, will ask established importers to cut back their imports to make room.

. . . **It may place** product imports under some control.

Top figures in the Government attended last week's session but had no announcement at the close. It was learned, however, that not until late in March would a recommendation be made to the President.

Another meeting will be held, but no date was announced.

Among those attending were Commerce Secretary Weeks, Secretary of State Dulles, Imports Administrator Matthew V. Carson, Jr., and Consultant Herbert Hoover, Jr.

The statistics . . . Meanwhile, Carson released figures showing that most companies are complying with the voluntary program, with a few notable exceptions (see table, Districts 1-4).

In the West Coast District 5, the program is in good shape. The allocation for the first 6 months of 1958 is 220,100 bbl. per day, and January imports totaled only 162,100 bbl. Estimated imports for February through June are 196,400 bbl.

In Congress . . . While Carson and the cabinet committee worked on administration of voluntary controls, the House ways and means committee heard arguments on whether the program should be junked for mandatory controls.

Independent producers opened their drive for an amendment to the Reciprocal Trade Agreements Act that would hold imports of crude and products to the same ratio to domestic demand as existed during 1954.

The amendment states that any imports over this level will be deemed to endanger domestic security and shall be disallowed. Some witnesses proposed an import tax of 30 per cent, about $1 per barrel, and other penalties.

The President has asked Congress to extend the trade act for 5 years without change, and the committee should vote on the issue in a month.

Robert L. Wood, chairman of the executive committee of the Independent Petroleum Association of America, set the tone of testimony by saying at the outset that the voluntary program is "commendable and constructive" but that it has not done the job.

Wood explained that his 1954 ratio amendment would permit only 760,000 bbl. of crude daily to be imported but that 975,000 bbl. is currently planned. As for oil products, Wood said the proposed amendment would allow only 455,000 bbl. daily, compared with 575,000 bbl. planned.

The coal industry joined the producers in asking for quotas. C. J. Potter, president of the Rochester &

Most Importers Comply—A Few Don't

(Dist. I-IV, Thousands Barrels Daily)

	Actual Jan. 1958	Estimated, 5-Mo. Avg. Feb.-June, 1958	Actual, July 1957-Jan. 1958	Allocation Year End 6-30-58
Established Importers				
Atlantic	56.7	55.7	61.2	58.9
Gulf	112.8	107.6	114.4	111.6
Sinclair	76.2	60.0	63.9	62.2
Socony Mobil	67.3	67.1	71.1	67.1
California Standard*	69.9	66.3	67.2	66.8
Jersey Standard†	41.0	75.6	66.6	72.0
Texas	68.9	50.1	56.0	54.5
Subtotal	492.8	482.4	500.4	493.1
New Importers				
Cities Service	32.0	34.2	31.2	32.6
Crown Central	6.8	6.0	1.6	5.0
Eastern States†	25.8	26.3	25.0	18.3
Gabriel	19.2	11.7	4.6	7.5
Great Northern	33.2	33.0	30.1	33.0
International	9.5	12.1	9.0	12.3
Lakehead Pipeline	0.2	0.3	0.4	0.3
Lake Superior†	8.0	6.7	4.7	5.0
North Western	17.5	15.6	9.9	13.5
Phillips	3.5	15.7	9.0	12.0
Shell	4.7	12.5	1.4	7.5
Indiana Standard	29.6	26.2	32.3	29.8
Ohio Standard	3.9	9.2	7.5	8.2
Sun	57.6	52.5	59.0	50.4
Tidewater	70.9	50.3	69.0	34.2
Southwestern†	3.7	3.0	2.5	2.9
Bay Refining	5.3	5.5	2.9	3.2
Dow Chemical	0.3	0.3	0.3	0.3
Texas Asphalt	0	3.5	0	2.3
Subtotal	331.7	324.6	300.4	278.3
TOTALS	**824.5**	**807.0**	**800.8**	**771.4**

*Includes American Bitumals. †From Texas R.R. Comm.

Pittsburgh Coal Co., Indiana, Pa., proposed that the trade act be extended only 1 year, so conditions could be reviewed next year.

F. Allen Calvert, Jr., president of Calvert Drilling, Inc., Tulsa, and chairman of the IPAA import policy committee, testified that the number of active drilling rigs dropped 7.6 per cent in 1957 under the previous year and that well completions fell 7.4 per cent.

Calvert said a continuation of these trends could mean that fewer than 50,000 wells—oil, gas, and dry—would be drilled this year.

How they stand . . . Four of the most influential members of the committee showed sympathy for the proposed quota amendment by their questions.

They are Chairman Wilbur Mills (D-Ark.), and Reps. Richard Simpson (R-Pa.), Frank Ikard (D-Tex.), and Noah Mason (R-Ill.).

Four others indicated they take a dim view of the quota amendment. They are Reps. Howard H. Baker (R-Tenn.), Herman Eberharter (D-Pa.), Thomas B. Curtis (R-Mo.), and Robert W. Kean (R-N. J.).

The ways and means committee will continue hearings through March 20 and is not expected to report out a bill until April.

Tidelands Climax

set for fall when Supreme Court will hear arguments.

THE U. S. SUPREME Court has set up a timetable for legal maneuverings in the government-state struggle over ownership of oil-rich offshore areas in the Gulf of Mexico.

The maneuverings will climax October 13, the date set by the court for new arguments in the case.

The court issued an order last week giving all parties 30 days to confer and submit to the court a proposed schedule of deadlines.

These will cover filing briefs, the order of appearances, and the time allowed each party for argument. The schedule, the court said, should call for filing all briefs before September 15.

At stake in the case is the boundary line in the gulf for Louisiana, Texas, Mississippi, Alabama, and Florida. The Government claims state ownership ends 3 miles from the main shore line. Louisiana, the original defendant, however, contends the 3-mile limit should start with lands off its coast.

Other states were made parties to the case at the court's insistence.

watching WASHINGTON

. . . with Bertram F. Linz

• Saving money outside of court

CONSENT-DECREE settlements of antitrust suits against the oil and other industries are gaining in favor.

Justice Department officials, harassed by lack of money and manpower, are trying to popularize these give-and-take settlements reached in an office rather than a courtroom.

Study shows that the average case can be settled by consent in little more than half the time it would take to go through the courts. The saving in manpower and money is significant.

Industry, too, is finding these settlements attractive. Since it usually costs much more to defend a suit than to prosecute it, there is an element of economy.

But there are two other factors which in some cases are even more important.

Judgments entered by consent before trial sharply cut chances of successful suits for the treble damages provided under Section 5 of the Clayton Act. Complainants in such cases would have no court evidence to back their demands.

The second inducement is the avoidance of the unfavorable publicity which often attends antitrust suits involving industries in the public eye.

• Oil probes may fall by wayside

FEW MEASURES adverse to the oil industry will get through Congress this year.

With 2 months of the session gone, the pressure of time already is being felt. Many of the oil studies planned for this year will not be finished in time for action.

In the Senate, most of the heat on oil was generated in the antimonopoly subcommittee headed by Sen. Estes Kefauver of Tennessee.

Kefauver has just wound up hearings on administered prices in the auto industry and is turning to other lines which eventually may include gasoline.

But he also wants to probe the merger situation, the foreign operations of American companies, the Supreme Court's "good faith" decision, and assorted other matters.

Kefauver has a $365,000 fund for this work. But he has so many irons in the fire that it is not likely that many of them can be hammered into legislation this session.

• Congress blasts at misconduct

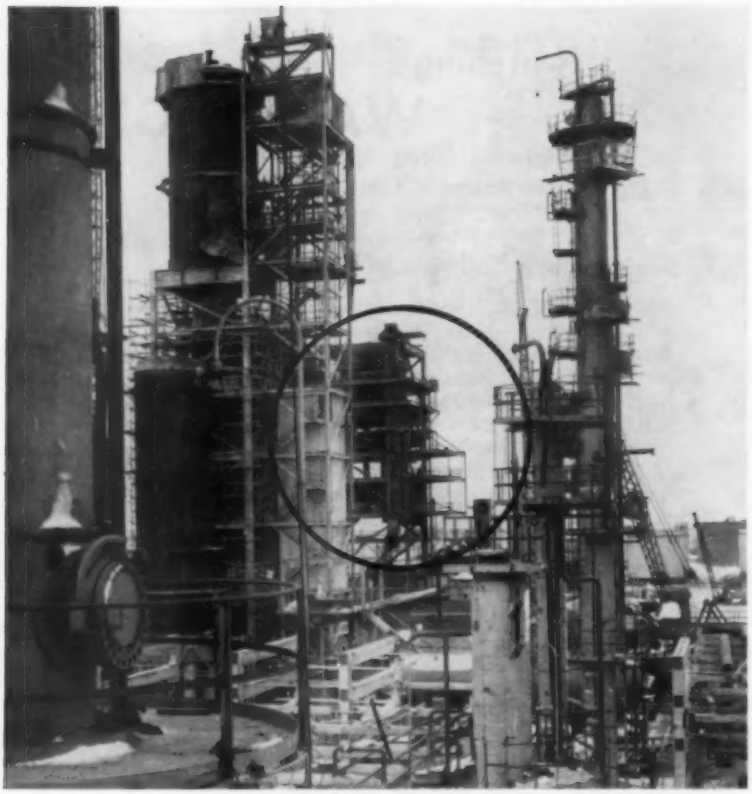
RECENT DISCLOSURES of financial, political, and personal pressures applied against federal regulatory officials will lead to the writing of a stiff law against misconduct.

A House probe started last year is still working on the Federal Communications Commission. The FCC issues, for free, radio licenses which can be and have been sold for millions.

Other agencies are being lined up for study after the mess in the FCC has been aired. Eventually, there will be inquiry as to whether the gas and power industries have put pressure on the Federal Power Commission.

The use of money, politics, and friendship to sway officials is nothing new in Washington. Scandals rocked the Harding administration. There was criticism of the Roosevelt regime. And five percenters had a field day during Truman's term.

The only thing new is that Congress finally seems to have decided to do something to protect officials against themselves.



TOLEDO REFINERY gets a new CO boiler. It means . . .

Fuel-Bill Savings for Sohio

REFINERS are fast catching on to the economy of recovering additional heat by burning carbon monoxide from their catalytic cracking units. The largest such CO boiler yet designed (circled in photo) is now nearing completion at the new Toledo, Ohio, refinery of Standard Oil Co. (Ohio).

The boiler will cost Sohio $1,250,000 and will be worth the price. Hot flue gas from the cat-cracker regenerator will contribute some sensible heat for steam generation. The rest will be derived from burning carbon monoxide to carbon dioxide. Altogether, the unit will save about 200 million B.t.u.'s per hour to produce 450,000 lb. of steam.

The Toledo unit, built by Babcock & Wilcox Co., has another point of interest. It will be the first such unit to produce the uninterrupted steam demand of the entire new refinery. It will provide steam for operation of the two-stage crude distillation unit, the delayed coker, catalytic cracker, poly unit, the catalytic reformer, and the hydrogen treating plant. It also will serve gas recovery, stabilization, gasoline treating, and blending facilities.

B&W is building a medium-sized, gas-fired boiler to supplement the CO boiler for peak demand. At prevailing fuel costs in the Toledo area, it is estimated the CO boiler will pay out in the relatively short period of 3 years or less.

The unit will serve another less tangible purpose in eliminating any atmospheric pollution problem which might arise from discharge of cat cracker flue gases.

New Catalyst Developed

"NICOMO 1" is the name given to the newest hydrogen treating catalyst just introduced by Davison Chemical Co. As its name implies, it is a nickel-promoted cobalt-molybdenum catalyst on a low density alumina base.

According to Davison, the new catalyst offers the refiner lower cost operation, better desulfurization, and improved versatility.

In a 6-month commercial test on a mixed high sulfur catalytic cracked and virgin No. 2 fuel oil, a direct comparison was made with another commercial catalyst. About 25 weight per cent less Nicomo 1 was required to fill the reactor with an equal volume of catalyst. Under relatively mild processing conditions, the new catalyst showed a 6-9 per cent superiority in desulfurization activity, according to Davison. At an age of 70 bbl. per pound, Nicomo 1 still exhibits an 8 per cent advantage, with improvements in color, neutralization number, and gravity.

The catalyst is the result of extensive research conducted by Gulf Research & Development Co .at Harmarville, Pa.

Tribe Wants More

for oil leases. Navajos say Utah bids are inadequate.

THE NAVAJO TRIBE, which turned down bids offered December 10 for oil leases on six tracts of tribal lands in Utah, will also reject some of the offers received in the second bid opening last month.

All bids are being weighed in the light of the geology of the area, the location of the lands in respect to bonuses received on nearby tracts, and the relation of the lands to known structures.

The Navajos are running a series of four lease sales, three of which already have been held. The final opening is scheduled March 17. The lands offered total 370,000 acres.

The December bids rejected carried offers of $105 to $318 per acre. The tribe's oil consultant, Martin T. Bennett, and its geologist held that the offers were inadequate.

Norman M. Littell, Washington representative of the Navajos, explained that the tribe has set up criteria which will be followed in disposing of all oil lands. The increase in royalty from one-eighth to one-sixth will be maintained except possibly on remote lands, he said.

There has been no announcement whether the tracts on which bids were rejected will be reoffered. Littell expressed the opinion new bids will be called for if asked.

The bids received in the January 15 and February 11 openings are now being studied. In light of the December experience it is expected that some will fail to measure up to the tribe's standards.

The land involved in the Navajo sales includes some of the best oil-prospecting acreage in the Rockies. At the December sale, Carter Oil Co. made a record bid for Indian lands in the Rockies when it paid $4,308 per acre for a tract northwest of McElmo Creek in San Juan County, Utah.

Congrats and $25 to LEE BLACKER, 843 Belmont Ave., Long Beach, California.

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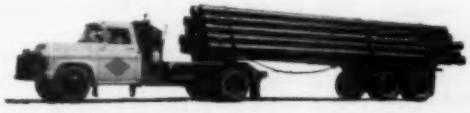

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RALPH E. DAVIS draws on years of experience to answer Joe Reilly's question:

Does FPC Control Raise Gas Prices?

GAS PRICES, historically, have tended to increase according to the law of supply and demand. The increase has continued in spite of—or, perhaps, because of—government regulation.

The intent of government regulation is to depress prices, but the effect of federal control on the law of supply and demand may bring the opposite result.

This relationship between regulation and prices is discussed by Ralph E. Davis, widely respected Houston gas consultant, in an interview with Joe Reilly, Houston district editor of The Oil and Gas Journal. Davis also discusses in the interview the prospects for demand growth for gas and new reserves.

Q. Do you feel that the price of gas now has just about reached its ceiling?

A. From the standpoint of the history of the business, one would conclude that the prices for gas in its principal markets have not yet reached their top.

No one can be sure when the peak will be reached. New ideas, whether they be good or bad, will have an influence, and I suspect that after a period of probably a few years the inexorable strength of economic forces will overcome the beautiful theory of those who would like to maintain an ever-increasing supply of gas at a price insufficient to bring it about.

Q. If we had no FPC control, how high would the price of gas be, say in South Louisiana?

A. The price of gas in South Louisiana, in good fields of substantial reserve and well located, is within the range today close to 20 cents per M.c.f., some prices higher and as much as 22.4 cents, and some prices under 20 cents. No one can answer your question with certainty, but we may review what has happened and try to judge the results.

The FPC has, in general, tried to keep the price of gas down. They have used their position and power, and not to my knowledge have they influenced the price upward.

But, there are other influences on prices that have resulted from FPC activity. Producers have for a number of years generally been fearful of what will be the result of coming under FPC dictation as to prices.

This has led them to withhold from interstate markets gas in very substantial volumes. They have been waiting for an ultimate clarification of the issues involved, or where it has been feasible to do so, have been contracting to sell gas in intrastate markets. The latter has been substantial.

The withholding of large gas reserves from the interstate markets has resulted in creating to a deeper degree what the world calls a "seller's" market.

Q. Then, would you say that Government controls, in some instances, have tended to increase rather than depress gas prices?

A. Those who are willing to take a chance on ultimate FPC rulings have been able to command the price which they may not have been able to command had the supply of gas in the market place been more plentiful.

Whether or not the pressure down on prices has exceeded the pressure up, I am unable to judge, but I do know that it has been extremely difficult for the interstate pipeline companies to contract for their neded additional reserves for their proposed expanding markets.

Had there been no fear of FPC control of prices, it is certain that gas available to interstate markets would have been far more plentiful, and in all probability, less costly.

Q. What will happen to gas prices

in the future if they continue to be set by government edict?

A. Over the long run, and I do not mean too long a time, the cost of gas will increase, and no government authority can change that. All they can do is to transfer the cost from those who maybe should pay for it to those who, through taxes, will have to share it.

Q. What effect have Government controls had on the development of new gas reserves?

A. Exploration has continued, but it has been declining during the past year, not only because of the fear of FPC rulings on prices but also because of the softening of the economic situation which has developed during the past year.

It is true that where discovery has resulted in new-found reserves, there is a notable tendency of the operator to delay the drilling of wells which could result in increasing the reserves, or in any case, making the reserves more available to a market.

Whether the net result of the Federal Power Commission in South Louisiana has been to lower the average price as of today, as some think is the case, or to increase it as many close to the subject believe, it is certain that their policy, activity, and power have resulted in the withholding of important amounts of gas in the interstate markets.

Maybe that is what will eventually be found to be in the public interest, but that cannot be too certainly judged at this time.

Q. Will you touch upon the major gas-producing areas in the future?

A. We have all seen the great expectancy of certain geologic regions which, when explored, have to date failed to measure up.

The Gulf Coastal Plain and the adjoining offshore area on the Continental Shelf of Louisiana and Texas stands today not only the greatest of all our present stores of found and proven reserves but, as far as expectancy in the future, equal or greater than any other similar area in the United States.

Q. Do you foresee a shortage of natural gas in the next few years?

A. In most of our oil and gas provinces, the additions to reserves by discovery have not been equal to the withdrawals in recent years. No one can foresee what may be found in these places.

But exploration has been active, and results fail to indicate to me that the trend of recent years will be turned upward, except occasionally, and then probably for a short-time period.

Q. Then you think we're about to reach the leveling off point in net additions to gas reserves?

A. Those who talk about gas delivered to markets in the United States in 1980 in volumes triple that of today should realize that they are playing with trends of the past and not dealing with facts as we know them.

This year we will require 11 trillion feet of gas to meet the nation's needs. It is true that in every recent year we have found by discovery and by extensions and upward revisions more gas and more oil than we took out of the ground.

The discoveries have been a small portion of each year's total, and upward revisions and extensions cannot go on forever.

Q. How will Canada fit into our reserves picture?

A. There is great talk in the oil and gas circles about the importance of Alberta.

In that great expanse, equal in area to Texas, the total gas found to date is only about two-thirds of the gas that was found in the Panhandle field, slightly more than half of the gas that has been found in the Hugoton field; and, although the expectancy is great, it is easy to overestimate.

Demand

Q. Would you like to say something about the future growth in the demand for natural gas?

A. We all know that gas has not yet been made available in substantial portions of the country. Gas is in Minneapolis. Gas is in Milwaukee and of course in many other cities and towns in Minnesota and Wisconsin. But gas has not yet been taken to Duluth and to many cities and towns in that region.

Further, the demand to meet requirements of new customers in the cities now being served continues to be great. In St. Louis only about one-fifth of the gas customers are now using gas for space heating, and the gas company there is adding space heating service as rapidly as their peak gas supply arrangements can be brought into use.

Q. Where will the increased demand come from?

A. Gas storage has become in the last 10 or 15 years an enormously important side of the natural-gas supply industry.

With the present storage facilities that are in the planning stage, there is no doubt that a very substantial increase in space heating and use of gas for other household purposes will be the greater part of the increased demand of the future.

As time goes on, I believe the cost of gas will make it impractical to compete in many places where today it does compete with coal and oil.

Q. How big a chunk of the future gas demand will come from the petrochemical industry?

A. The petrochemical need for gas has expanded rapidly and should continue to increase greatly, but today the total gas for that purpose is almost inconsequential as compared to the other requirements.

Over the long future I believe our natural gas is going to serve mainly the domestic markets, the petrochemical requirements, and, to a gradually decreasing extent, the industrial market.

For the good of the industry, and that means to the good of the consumer, distributor, the pipeliner, and the producer, it is desirable that changes in these matters be brought about gradually, and as circumstances make it practical to do so, rather than by edict from government.

Buyer Proration

is questioned in New Mexico. Gulf and Malco must appear.

THE NEW MEXICO Oil Conservation Commission has ordered both Gulf Oil Corp. and Malco Pipe Line Co. to appear at its March 13 meeting to show cause why they should not be ordered to cease prorating purchases.

Both firms notified the commission they do not intend to buy their entire allowable for March. Gulf said it would cut its purchases 21,000 bbl. per day to 80 per cent of its January total.

Commission Engineer Dan Nutter said that unless the companies can show valid reasons why they must reduce buying, the commission will order them to take their entire allowable from connected wells.

"We wouldn't be asking them to come in and show cause if we didn't believe we had that authority," Nutter said.

Cities Service Oil Co. prorated its purchases in New Mexico from February 15 to 28, but resumed full-scale buying effective March 1.

Gulf recently was fined $305,000 by the Oklahoma Corporation Commission for failing to get permission to cut its purchases below its allowable in Oklahoma. The company is appealing the decision to the courts.

Big Gas Strike Spurs Interest

MAGNOLIA Petroleum Co. and Western Natural Gas Co. have completed their spectacular dual gas discovery in one of Texas' least-explored areas and are ready to sink another 15,000-ft. test in the same area.

Triggering the new interest in the Val Verde basin of southwestern Texas is the 1 Brown-Bassett. It was finaled flowing 20,650 M.c.f. of gas daily from Silurian perforations at 12,387-12,446 ft. through 36/64-in. choke.

The wildcat is the first pre-Pennsylvanian gas strike in Terrell County. Earlier, a 1,600-ft. Ellenburger section tested up to 15,000 M.c.f. of gas daily at about 14,200 ft. This zone won't be produced, however, due to what the operators term "mechanical and hole problems."

The big discovery is playing a key role in Transwestern Pipeline Co.'s plans to lay a 1,200-mile 30-in. natural-gas line from West Texas to California.

Plans now call for the eastern terminus to be near the new strike. The line will extend from there northwest to the Puckett field in Pecos County then on to California via the Four Corners area.

Magnolia's 2 Brown-Bassett has been staked about 1½ miles south of the discovery, which is 39 miles northeast of Sanderson and about 50 miles southeast of Puckett field. Puckett has production to about 15,000 ft.

Wild well . . . The discovery first made news when it blew out last August while drilling at 12,407 ft. in the Silurian. This was the first Silurian strike in the region. The operator capped the blowout, went back in the hole, and came up with the Ellenburger bonus (OGJ, Feb. 17, p. 193).

Geologically, the area is considered within the Val Verde basin, although it lies in the eastern outlet of the Sheffield channel.

Previously, Pennsylvanian gas had been found at 5,600 ft. 2 miles southeast of the discovery. The only other production in Terrell County is at Spencer field, a small gas pool 20 miles north, which has production in the lower Permian section.

Gas line . . . Transwestern's proposed line was originally projected from the Four Corners area to California, but the company was forced to extend it to West Texas to assure adequate gas supplies.

In Dallas last week, Robert M. Chan, gas procurement advisor for Transwestern, said the company hopes to apply to the Federal Power Commission by April 1 for permission to lay and operate the line. If the permit is granted, construction will begin this fall.

The new company, which would become a competitor of El Paso Natural Gas Co. for the lush California gas market is owned by Monterey Oil Co., Los Angeles; Warren Petroleum Corp., Tulsa; and J. R. Butler and associates, Houston (OGJ, July 8, 1957, p. 75).

PIPELINE BRIEFS . . .

Southern Natural Gas Co. plans to build 1,200 miles of new pipelines to expand its system from South Louisiana by 300,000 M.c.f. per day.

The expansion, filed with the Federal Power Commission last week, would cost $64,500,000 and require 12 to 18 months to complete. The timing is uncertain, however, because of the Memphis decision.

Southern Natural could use the added capacity almost immediately. It was forced to suspend industrial and commercial service to supply space-heating requirements during recent cold weather.

Continental Oil Co. is buying approximatly 25 per cent interest in the products pipeline which Ohio Oil Co. plans to construct this summer from Wood River, Ill., to Chicago. The 340-mile, 12-in. line, with ultimate capacity of 90,000 to 100,000 bbl. per day and initial capacity of 40,000 bbl. per day, will connect with an 84-mile, 12-in. line from Ohio's Robinson, Ill., refinery at Champaign, Ill. Conoco will deliver products from its affiliated Cherokee system from Ponca City to Wood River. Cherokee capacity is being doubled to 60,000 bbl. per day.

Clark Oil & Refining Corp. has awarded a contract to Midwestern Contractors, Inc., Wheaton, Ill., to build a 15-mile products pipeline from Clark's Blue Island refinery to East Chicago. The project should be completed within a month.

El Paso Natural Gas Products Co. is building a 42-mile crude-gathering system in the Verde Gallup-Horseshoe Canyon area of San Juan County, New Mexico. Contractor for the 2 to 8-in. system is Northwest Construction, Inc., Farmington, N. M. Construction is being supervised by Products Pipeline Co., subsidiary of the products company. Completion is due April 1. Polyvinyl-chloride pipe is being used for 12 miles of 2 in.

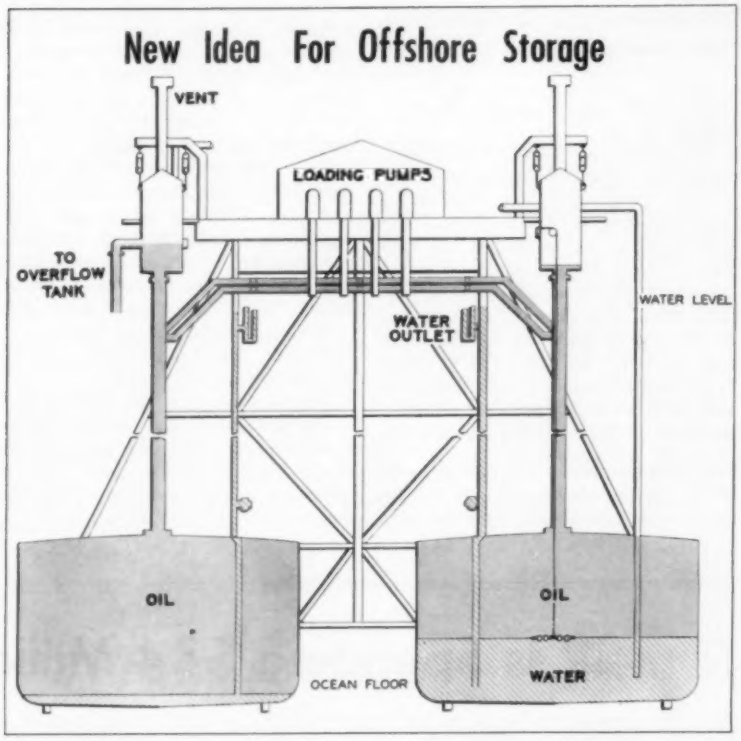
Northwestern Utilities, Ltd., will build a 45-mile, 16-in. gas line from Pembina field to Calmar, Alta., and 47 miles of 4 to 16-in. gas-gathering lines in Pembina field. The project, including one 16-in. crossing of the North Saskatchewan River, has been let to Mannix Co., Ltd. The line will bolster the gas supply of Edmonton.

Mannix, under a continuing contract, will lay some 50 miles of crude-gathering lines in Pembina this year. Mannix has completed more than 500 miles of 3 to 16-in. lines in Pembina.

Also for Pipeliners . . .

IN THE NEWS: Hopes for early Supreme Court review of the Memphis decision have been dealt a blow. October now seems earliest date for hearing (p. 83) . . . Midwestern gets a break on southern leg of its proposed Tennessee-to-Canada line when Peoples Gas withdraws opposition. It means new gas supplies may be in Chicago by next winter (p. 90) . . . Borden Commission report is ready, but its recommendation for a gas policy for Canada is being held up until after federal elections (p. 91) . . . Calvert Drilling has opened the seventh gas field in Woodward County, Oklahoma, in less than 14 months (p. 92) . . . FPC controls tend to push price of natural gas upward, expert says (p. 98).

PLUS THESE TECHNICAL REPORTS: Natural gas has made rapid growth in last 20 years (p. 108) . . . New information sheds light on factors influencing gas prices (p. 110) . . . Advances in gas pipeline technology during 1957 (p. 115) . . . Feature articles on pipeline operations (pp. 128-176).



Sea Terminal Would Cut Costs

LAKE MARACAIBO may become the proving ground for underwater storage of crude oil from offshore fields.

A "sea terminal," at which medium or supertankers could load, has been designed for 100-ft. water serving new fields in the Venezuelan lake.

The proposed Maracaibo terminal is one of several such designs intended to cut production and transportation costs offshore. It was designed jointly by Sea Engineering & Salvage, Inc., Houston, and Robert H. Macy, naval architect representing McLean Industries, Mobile, Ala.

The submerged installation, operating with a gathering system, is being considered as an alternative to a 40-mile pipeline and shore-based terminal to handle crude from new concessions.

In the above design, discarded midsections of T-2 tanker hulls would be used to build the underwater tanks. The sea terminal would have a capacity of 250,000 bbl.

John A. Hughes, of Sea Engineering & Salvage, unveiled the new design at a recent meeting in Houston of the Gulf section, Society of Naval Architects and Marine Engineers.

As in other proposals, water would be used to displace oil in storage. The new system incorporates an adjustable overflow which can be set at a predetermined level above the water line. Hughes points out that oil going into storage will overflow to another tank before it reaches the water outlet, which extends to the lower part of the vessel.

As oil flows into the tank, water is displaced through the water riser. As oil is discharged, water enters the tank below the level of the oil.

Because of the difference in specific gravity of oil and water, hydrostatic pressure can force crude from storage. However, pumps can be used to reduce the time required to load a tanker.

Water inflow check valves are the only moving parts below the water line. There are no valves or fittings on the oil side as a possible source of contamination.

Research has indicated that corrosion and maintenance of completely submerged storage facilities are not major cost factors.

Hughes estimates a sea tank farm of this size, complete with gathering system, would cost about $20 per barrel of storage. This compares with costs ranging to approximately $50 a barrel for small storage tanks mounted on platforms.

Large underwater storage facilities would permit transportation of crude by medium tankers rather than barges. This would save another 8 to 35 cents per barrel, Hughes believes.

He points out that some wells in the Gulf of Mexico are now shut in, even though a pipeline is available, because they will not flow into the gathering system and because storage facilities are too expensive.

Ghawar Gas Plant

being built to reinject gas into big Saudi Arabian field.

ARABIAN AMERICAN OIL CO. has started work on gas reinjection in the Ain Dar area of Saudi Arabia's Ghawar field.

Key facilities in the gas conservation project will be a 200,000-M.c.f. injection plant and a 5,000-kw. power plant. Work should be completed by November and the plants in operation early next year.

Ain Dar is in northernmost Ghawar field, which extends more than 150 miles along a north-south axis. Ghawar normally produces more than 600,000 bbl. daily from about 88 wells.

The conservation plant is located near gas-oil separation plant No. 3 Six turbines delivering 50,000 hp. will drive five gas compressors and a generator.

Gas will be taken from separation plants Ain Dar Nos. 1, 2, 3, and 4, and Shedgum 1. It will be stepped up in five stages from 150 to 2,000 psi. and sent through transmission lines for several miles for reinjection into north and south domes of Ain Dar.

The power plant will serve both the injection plant and the separation plants, where electric motors are replacing gas-driven turbines used on oil pumps. A 66,000-volt transmission line from Abqaiq will tie the facilities into the Dhahran, Ras Tanura, and Abqaiq power systems. This will permit operation at Ain Dar in case of local power failure.

The reinjection program is the second undertaken in the Middle East. The first was at Abqaiq field, 20 miles northwest. A 150,000-M.c.f. plant opened there is 1954, and a water-injection program started 2 years ago.

Two Strikes by Aramco

. . . in Saudi Arabia. One wildcat discovery is 75 miles from nearest production. The other is a new-zone Gulf producer

SAUDI ARABIA last week chalked up two new oil fields and one entirely new pay zone as a result of the country's two latest wildcat wells.

Arabian American Oil Co. completed both its recently drilled wildcats as producers. One, Khurais 1, is far inland and 75 miles from the nearest production. It can produce from 3,000 to 4,000 bbl. daily from the familiar "D" member of the Arab zone.

The second wildcat is by far the more interesting, both geologically and geographically. Manifa 1 was completed last week as Saudi Arabia's second offshore oil field. It produces from a zone that is not productive anywhere else in the country.

Khurais . . . Aramco extended its production a full 75 miles to the west with Khurais 1. The well was spudded last August on a structure located by gravity meter and core drilling in the Dahana, a shifting belt of sand dunes east of Saudi Arabia's central plateau. The test is in a region which the company believed to be marginal as far as prospects are concerned.

In October, more than 3 months ahead of its drilling schedule, Aramco tested the D member of the prolific Arab zone. From that moment on the company knew it had production. Since that time, the well has been tested further.

Last week, the well was completed in the D member after it was plugged back to 4,975 ft. from its total depth of 10,621 ft. The company said it tests from 3,000 to 4,000 bbl. daily of 33°-gravity sour crude.

Manifa . . . Aramco's second offshore discovery was completed through perforations of two intervals, 7,715-7,800 ft. and 7,810-65 ft., after the well was plugged back from a total depth of 9,637 ft.

The test is 8 miles off the Saudi Arabian coast in the Manifa Bay region of the Persian Gulf. It is just about halfway between Aramco's offshore oil field at Safaniya and the company's newly found productive onshore field at Khursaniyah.

After 3 months of testing, Aramco said last week that Manifa produces 26°-gravity sour crude from the Yamamam formation. The company gives no flow figures on the well but concedes the formation is "highly prolific." The oil is Saudi Arabia's heaviest so far.

The Yamamam is a Lower Cretaceous calcarenite alternating with fine-grained limestone. Not productive anywhere else in Saudi Arabia, the formation is the equivalent of the Ratawi zone found in the Neutral Zone in 1955. In addition to the new productive zone, Manifa 1 found the A, B, and C members of the Arab zone to be oil bearing. The D member, which produces at Khurais as well as in about 80 per cent of Saudi Arabia's wells, was dry at Manifa.

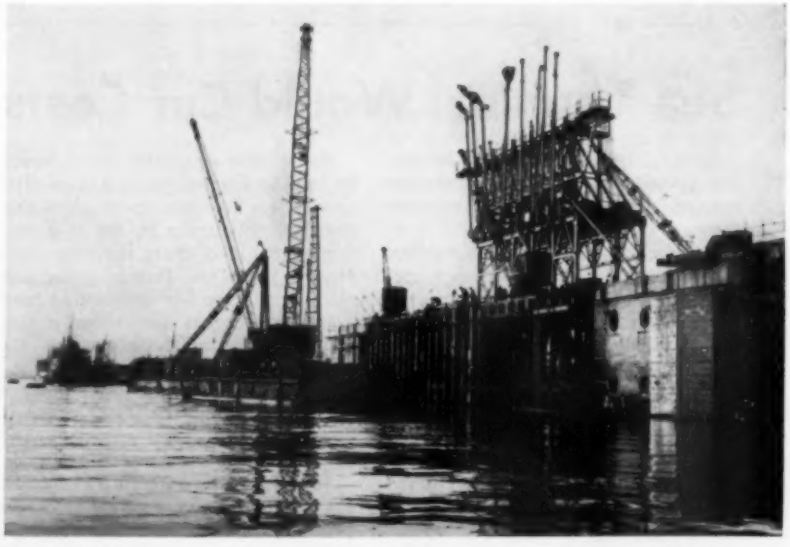
New offshore area . . . With two offshore fields already to its credit, Aramco appeared last week to have still another new Persian Gulf area in which to search for underwater oil.

The Saudi Arabian Government and the Sheikh of Bahrain, Sulman Al Khalifah, last week agreed to a 50-50 division of any oil found in the Persian Gulf waters claimed by both. Bahrain is an island in the gulf lying off Saudi Arabia and ruled independently by its own Sheikh.

The announcement of the agreement came from Manama on Bahrain and gave no details of the pact made by the two Arabian rulers except to say that King Saud of Saudi Arabia will determine how the waters are to be explored. This has been widely interpreted in the United States as an indication that Aramco will probably do the exploratory work.

Aramco has a mobile drilling platform now on its way to the Persian Gulf that could be used in the Saudi Arabia-Bahrain area for exploration. The company had the barge built in the U.S.

BP Is Spending $84 Million



CRUDE SUPPLY for expanded operations at Kent is picked up by this new Medway River jetty with the latest automatic hose-handling equipment . . .

THE VERY TOP of the barrel—and the bottom—are what the European oil consumer is buying these days, and that is what the refiner is turning out as best he can.

The $84-million expansion of British Petroleum Co.'s Kent refinery follows this demand picture right down the line.

The plant's new 90,000-bbl. crude distillation unit went on stream last week. It is the first of 21 new processing units that will be completed at the refinery between now and August. The crude unit takes care of the primary oil market in Europe—heavy fuel oil. The other units are designed almost exclusively for cleaning up and upgrading other fuel products and taking the top right off the barrel for

Paris Discovery Goes Deeper

THE FRENCH company with a new discovery near Paris is losing no time deepening the hole to a projected 10,000-ft. Ste. de Recherches Petrolieres dans la Region Parisienne (Petrorep) resumed drilling after recovering 50 bbl. of crude on a 75-minute drill-stem test in Coulommes 1.

The well, first discovery in the big Paris basin, is located 27 miles east of the French capital (OGJ, Mar. 3, p. 85).

The producing zone was topped at 6,060 ft. Crude flowed from a 75-ft. section, a pay slightly thicker than the 66-ft. zone originally estimated. Salt water was encountered at the lower edge of the producing formation. Sweet 44.5°-gravity crude was recovered from the Dogger section of middle Jurassic lime.

New Esso well . . . The Standard Oil Co. (N. J.) affiliate working in the Aquitaine basin has brought in a second well at Mothes structure, 9 miles northeast of Parentis field.

Mothes 4 came in as a producer at 8,000 ft. It flowed at the rate of 1,400 bbl. daily on a 2-hour test, apparently from dolomite. Preliminary indications are that it probably will be in the same class as Mothes 1, which flows 315 bbl. daily on production. The new well is a west outpost. The Mothes 2 and 3, to the north and northwest, were dry holes.

Esso-Rep is drilling ahead below 11,700 ft. in Parentis 102 after encountering gas shows higher in the hole. The gas apparently was recovered from fissures in Jurassic shaly limestone. No crude was recovered on Drill-stem test.

The well is on the south flank of Parentis structure about 1 mile south of No. 101, the first deep field test. The No. 101 is currently shut in. It averaged 50 to 100 bbl. daily on test, but declined rapidly.

Big Venezuelan Program Set

PAN COASTAL Petroleum Co. and Venezuelan Atlantic Refining Co. plan to drill 12 wells this year on their jointly held Guanipa concession in eastern Venezuela.

Two rigs will work in the Caro area where the four wells drilled each came in for over 1,100 bbl. daily. Thirteen sands totaling more than 250 ft. have been established as productive.

The best intervals are between 11,800-12,800 ft. and 12,800-13,700 ft. Several more promising sands remain for later testing.

on 21 Processing Units at Kent Refinery

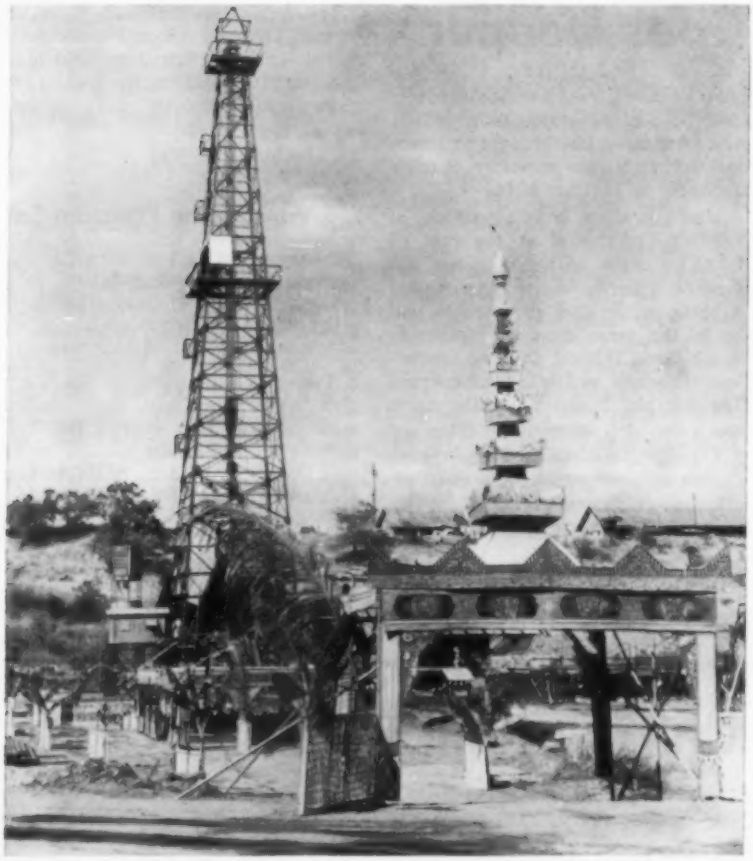
CRUDE'S first stop in this 90,000-bbl. distillation unit which went on stream last week.

LIGHT ENDS get specialized processing in these units. Tall tower at right center is an isopentane unit for avgas blending components.

aviation fuels. Automotive gasoline is the stepchild of the European refiner, and Kent is no exception. No expansion is planned for the plant's catalytic cracking facilities at all.

With the heavy emphasis on fuel oils and upgrading of all products, Kent's new units include a 12,000-bbl. gasoline stabilizer, a 900-bbl. isopentane unit to produce aviation-gasoline components, two 10,000-bbl. hydrofiners to desulfurize light diesel fuels, a 12,000-bbl. thermal reformer to produce gasoline and feed stock for the alkylation plant, a 10,000-bbl. catalytic reformer designed primarily for avgas components, and a 2,250-bbl. alkylation plant, also for aviation gasoline.

The other 13 units under construction are all designed for secondary product improvement and the production of sulfur byproducts. The expansion has increased the refinery area from 686 acres to 1,136 acres and added 122 new storage tanks 60 ft. high and 144 ft. in diameter. Four new jetties have been added, two for ocean-going tankers, one for coastal vessels, and the other for barges.



Pagoda Erected at Burma Wildcat

SANTA FE Drilling Co. crews have traveled far and wide to sink wells in distant corners of the world. But this may be the first time the natives showed their good wishes by building a golden pagoda in front of the rig to help the wildcat along.

The pagoda was built for the spudding in ceremonies at Ondwe, in Central Burma. U Raschid, Burmese minister for mines, officially spudded the test, the first wildcat in Burma since World War II.

Burmah Oil Co. (1954), Ltd., is drilling the well south of old Yenangyaung field. The test will be followed by future wildcatting in the Irrawaddy Delta.

Fish May Get Bolivian Grant

FISH ENGINEERING Corp. of Houston, apparently is winner of a large Bolivian concession with a bid which would give the Bolivian Government up to 65 per cent of net profits.

Reports from Bolivia indicated Yacimientos Petroliferos Fiscales Bolivianos, the government oil agency, has recommended acceptance of Fish's offer for the 108,000-acre Madrejones concession.

According to industry sources in the United States, Fish offered a 50-50 split of production from the concession, with the company to pay operating expenses. In event commercial production is established, it's estimated Fish would receive about 35 per cent of net profits.

Company officials in Houston said they had received no official word from YPFB regarding rumors that Fish would be awarded the concession. The contract, it was pointed out, must go through legislative channels and be signed by the President before becoming effective.

The concession area is south of the acreage formerly held by Glenn McCarthy, Inc., where exploration work is now being conducted by a Tennessee Gas Transmission Co. subsidiary. It borders the prolific Salta Province in Argentina.

Fish's letter of tender revealed that the company would pay $4,000,000 for the concession, with $2,500,000 of that sum being in the form of advance royalties. The company also would lend up to $13,750,000 to help purchase materials and equipment.

Shell Expenditures

will set record in Venezuela. Creole to match '57 budget.

A RECORD $200 million in capital expenditures for this year was approved last week by Cia. Shell de Venezuela, topping the 1957 spending program in Venezuela by almost $15 million.

The addition of an 80,000-bbl. atmospheric crude unit at Shell's big 170,000-bbl. Cardon refinery will account for a good part of the capital funds. The unit, along with several other processing units being added by the refinery, is due for completion late this year.

Another good slice of the money will go into Shell's new deepwater terminal, Puerto Miranda, on the east coast of Lake Maracaibo.

Another of Venezuela's giants, Creole Petroleum Corp., will spend $168 million this year, just matching the 1957 capital expenditures in Venezuela. The two companies account for more than 70 per cent of the country's oil production.

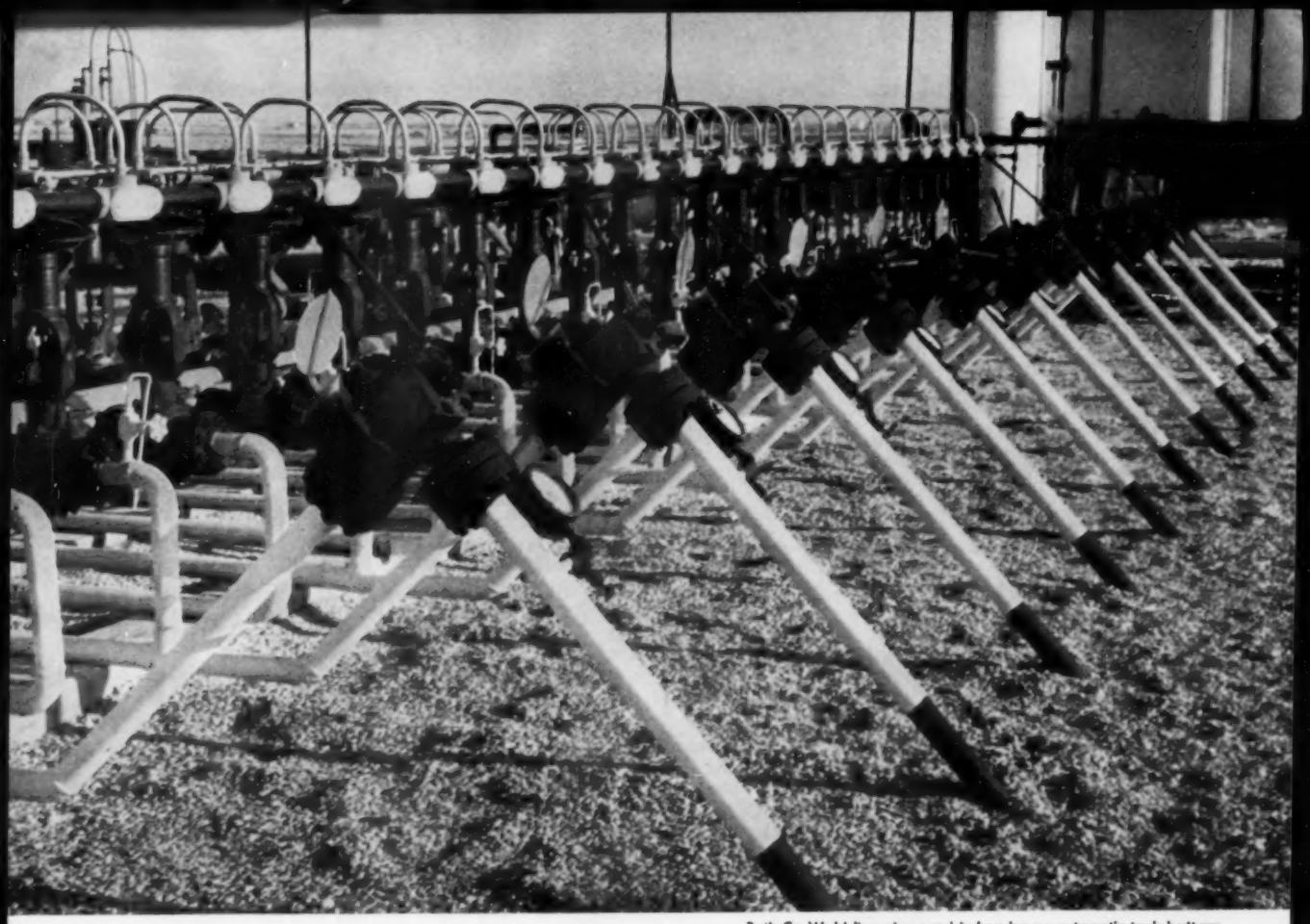
Ceylon May Get Refinery

A NEW REFINERY for southeast Asia became more of a possibility last week as a four-company combine got ready to propose a project for a plant in Ceylon.

If the move is successful it will end more than 4 years of dickering with the Ceylonese. A whole series of proposals by several companies have hit snags in the past.

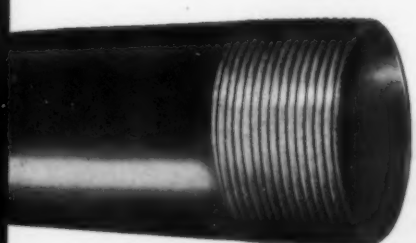
The latest move is being made by Shell British Petroleum, Standard-Vacuum, and Caltex. Representatives of the four companies were reported last week about ready to make another concrete proposal to the government at Colombo.

In the past the Ceylonese have balked on a long-term lease of port facilities and have refused to reduce import duties on crude. They have countered with demands for cut-price gasoline prices for local consumption.



Beth-Co-Weld line pipe used in header on automatic tank battery.

Beth-Co-Weld line pipe serves in so many ways



There are so many uses for Beth-Co-Weld line pipe around the lease or rig—so many places, such as gathering and distribution systems, service lines and maintenance work, where it can be used with complete confidence.

And Beth-Co-Weld is such good, sound pipe. It's made from a good grade of steel. In fact, Beth-Co-Weld was one of the first fully accepted types of continuous-weld line pipe made for the oil industry. What's more, Beth-Co-Weld saves you time, for it's readily available, either black or galvanized, from your johnny-on-the-spot Bethlehem Supply store.

ANSWERS TO QUESTIONS WE'RE OFTEN ASKED

Beth-Co-Weld meets the requirements of Specifications ASTM A-120 and A-53, and API 5-L.

It comes coated. Also uncoated for field wrapping, or mill-wrapped.

Sizes: Standard weights from ½ in. nominal through 4½ in. OD. Extra-strong weights from ½ in. nominal through 4 in. Nominal sizes 3½ in. OD and 4½ in. OD come in some weights lighter than standard.

Lengths: Single mill lengths. Also double mill lengths up to 50 ft in sizes 1½ in. through 4½ in. OD.

Types of Ends: Threaded and coupled; plain end beveled for welding; plain end square-cut, grooved for ring-joint coupling.

BETHLEHEM SUPPLY COMPANY
General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, New York

BETHLEHEM SUPPLY

Europe May Get Gulf Methane

. . . under Constock's plan to ship liquid fuel by tanker. South Louisiana terminal is approved for huge project.

FIRST SHIPMENTS of liquid methane to Europe may come from the U. S. Gulf Coast.

Constock Liquid Methane Corp., which is spearheading the drive for transocean shipment of liquefied gas, last week revealed plans for construction of a tanker terminal and barge ship in South Louisiana.

The loading facilities, as approved by the Calcasieu Parish police jury, are to be built about 6 miles southwest of Lake Charles, on the bank of the Calcasieu River.

Construction of the terminal also would require building of a gas liquefaction plant nearby.

Constock representatives declined to elaborate on plans for the project. The proposal was interpreted by other industry sources as a tipoff that the first supplies of methane for fuel-hungry England may come from Louisiana gas fields.

Details of the revolutionary plan to transport liquid methane were first announced 3 months ago (OGJ, Dec. 16, 1957, p. 59).

Earlier, indications had been that Venezuelan gas likely would be used during the early phases of the experiment, although the eventual use of U. S. gas had been widely discussed. Natural gas from Venezuelan fields is available at about 4 to 5 cents per M.c.f., while Gulf Coast gas in large volumes now commands a price of 20 cents or more per M.c.f.

Constock is owned jointly by Continental Oil Co. and Chicago Stockyards Co. Constock, in turn, has joined forces with the British Gas Council to convert an experimental tanker for transocean shipment of liquid methane. The tanker is due to be completed later this year, and deliveries to England are expected to start shortly thereafter.

The proposed loading facilities are to be built a short distance from Continental Oil Co.'s Westlake, La., refinery. The company also operates a natural-gasoline plant near Gillis, La., a few miles northeast of Lake Charles.

The river site is inland from big gas reserves now being developed offshore by Continental as operator of the CATC group. Most of these reserves are now committed to Tennessee Gas Transmission Co. for its eastern markets.

Plans for the terminal still must be approved by the Defense Department before construction can begin.

Insert Pipeline Map in This Issue

INSERTED in this issue is a two-color wall map condensed from the National Petroleum Council's recently released report on "Petroleum Transportation."

The NPC's Petroleum Transportation Committee is headed by B. I. Graves as chairman. J. R. Parten is vice chairman and John D. Freitag secretary. The report was developed by five subcommittees.

The subcommittees and chairmen are: Pipelines, C. S. Mitchell, Cities Service Co.; tank cars, B. C. Graves, Union Tank Car Co.; tank trucks, S. F. Niness, Leaman Transportation Co.; barge and lake tanker, A. C. Ingersoll, Jr., Federal Barge Lines; and LPG, G. R. Benz, Phillips Petroleum Co.

Work of the pipeline subcommittee was assigned to various PAD District chairmen, as follows:

Dist. I, R. D. McGranahan, Gulf Oil Corp., Pittsburgh; Dist. II, E. W. Unruh, Sinclair Pipe Line Co., Independence, Kans.; Dist. III, J. W. Emison, Texas Pipe Line Co., Houston; Dist. IV, R. F. Moore, Platte Pipe Line Co., Kansas City; Dist. V, G. A. Davidson, Standard Oil Co. of California, San Francisco.

Headquarters of the National Petroleum Council is 601 Commonwealth Bldg., 1625 K Street, N. W., Washington 6, D. C. Walter S. Hallanan is NPC chairman and James V. Brown, secretary-treasurer.

Offshore Drilling

to pick up in Venezuela as firms send new rigs south.

MORE OFFSHORE rigs are due to arrive in Venezuela soon to step up work on new concessions.

Phillips Petroleum Co. is bringing in a new rig to speed evaluation of Block 10 in Lake Maracaibo. Signal Oil & Gas Co. of Venezuela expects its second outfit to reach the lake's Block 4 late in March.

Paria Operations, Inc., also plans to bring in a new rig. The outfit will be the second to drill on its acreage in the Gulf of Paria.

The rigs moving to Maracaibo are going in the wake of new discoveries. Phillips recently brought in its first well on Block 10, the LSG-0-1, with a flow of 4,080 bbl. daily through a ¾-in. choke.

Signal has completed two Block 4 wells as producers. The Centro 2-X tested 2,400 bbl. daily, and 3-X, 4,000 bbl. daily.

Paria Operations is drilling ahead at 10,500 ft. in its first wildcat, Posa 112-1, in waters between Venezuela and Trinidad. Shows of 20°-gravity crude reportedly were found around 4,000 ft.

Shell Spuds Turkish Test

A ROYAL DUTCH-SHELL subsidiary has spudded its first wildcat in European Turkey.

The Thrace test, Teerzeli 1, is 120 miles by road west-northwest of Istanbul. It is 37 miles from the Greek border. Keir & Cawder Arrow Drilling Co., Ltd., of Glasgow, a subsidiary of Arrow Drilling Co. of Tulsa, is the contractor.

Royal Dutch is the second company to start wildcatting in Thrace since concessions were awarded 2 years ago. Esso Standard (Turkey), Inc., is below 7,000 ft. in its third test, located at Karapurcek, 110 miles west of Istanbul. Two other wells in the same general area, at Celan and Ofancik, were abandoned after being taken to basement.

Natural Gas and Natural-Gas Pipelining

. . . a special section

Important facts about natural gas—its relation to crude oil in the total energy picture, location of reserves, market, and growth prospects . . . **108**

How distance from market, volume of reserves, and other factors affect the price of gas . . . **110**

Refresher quiz covering pipeline operations and gas conditioning . . . **115**

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First gas line powered by engine-driven centrifugals at all downstream stations . . . **160**

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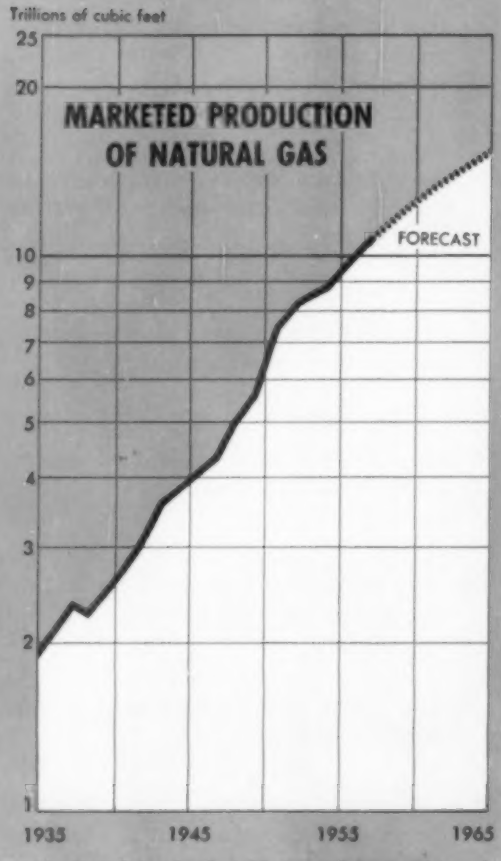
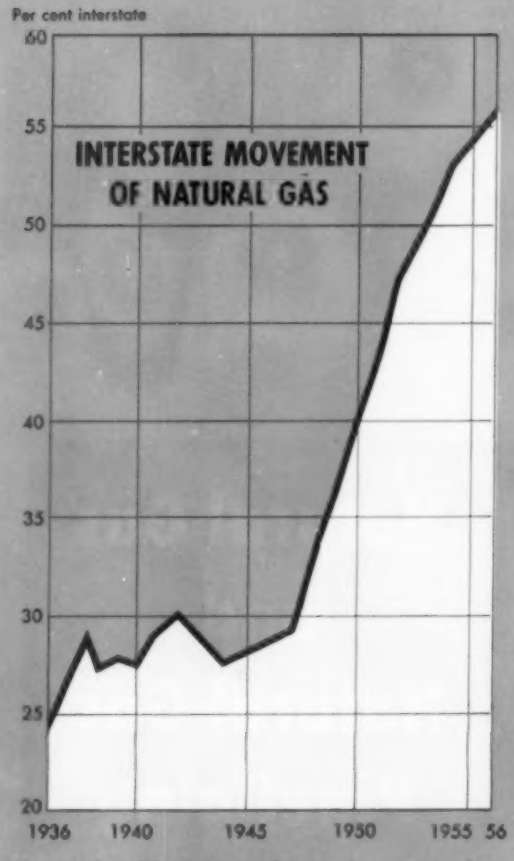
Cutting costs with unitized drive system. **178**

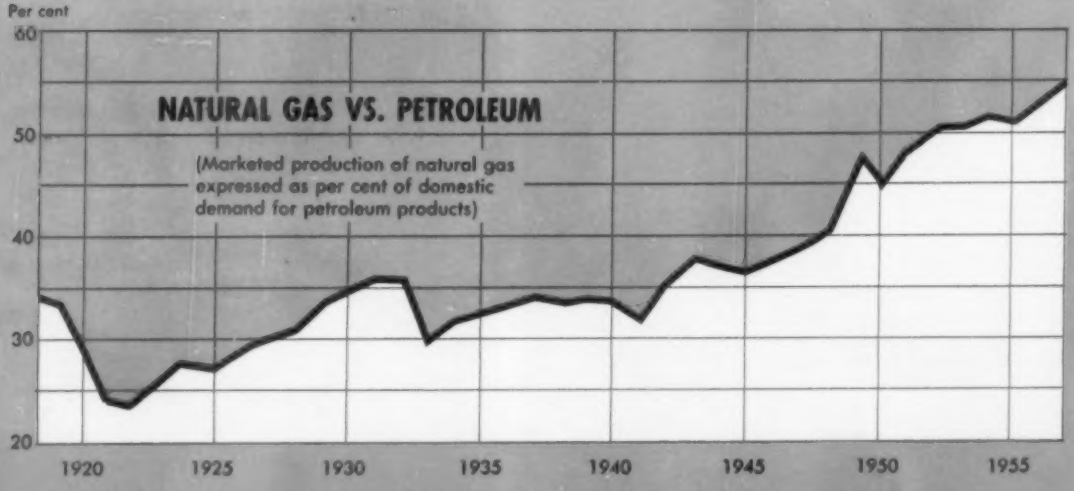
How natural gas has led in



Marketed production of natural gas will reach 15 trillion cubic feet by 1965.

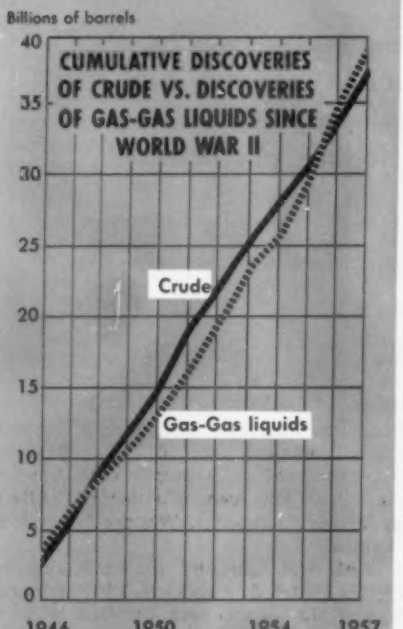


Less than 30 per cent of natural gas moved interstate until after World War II.

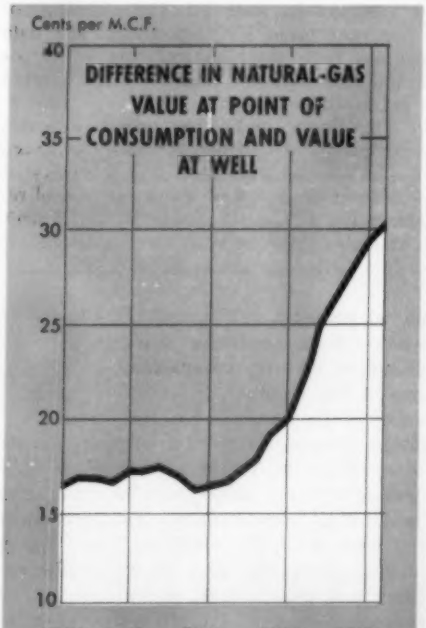


Natural gas now supplies 55 per cent as much energy as all petroleum products.

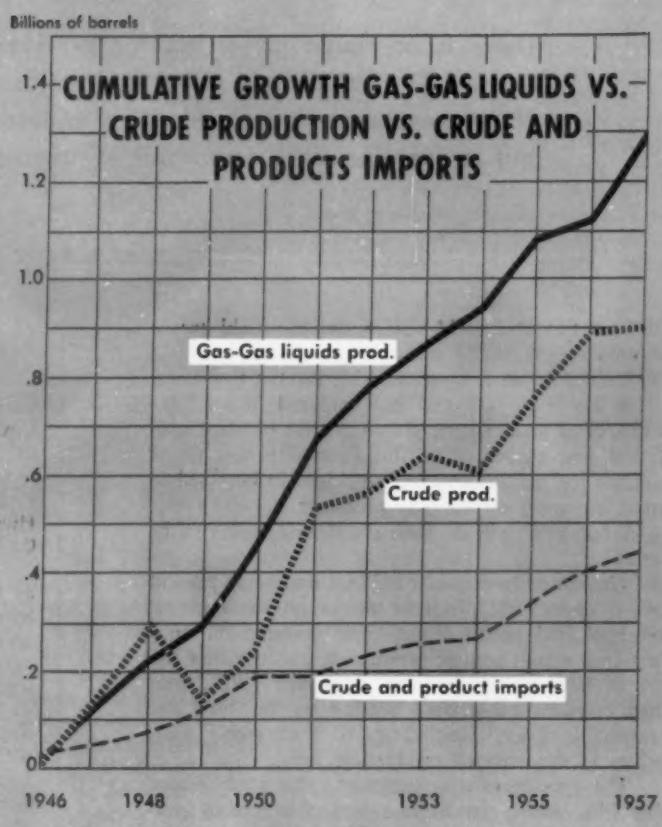
industry advances since war



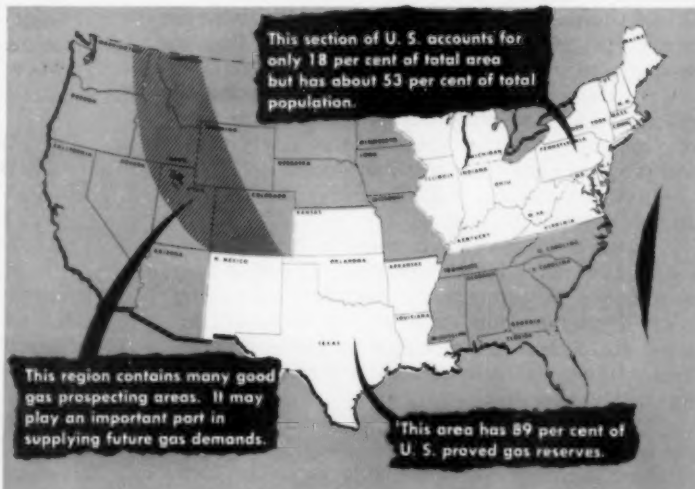
Since the end of World War II drillers have found more gas-gas liquids than crude.



Natural-gas prices average 30.5 cents per M.C.F. more at point of consumption than at the well.



Gas-gas liquids production has increased almost as much as crude production plus imports since 1945.


This section of U. S. accounts for only 18 per cent of total area but has about 53 per cent of total population.
This region contains many good gas prospecting areas. It may play an important part in supplying future gas demands.
This area has 89 per cent of U. S. proved gas reserves.

Present and prospective gas areas are far from population centers. This will call for more gas pipelines.

What's the price of gas?

There is no single price, but for the first time figures have been compiled on actual field prices and the factors that determine them. FPC may or may not use this study in determining producers' prices, but it contains much important information for the gas industry.

BY HENRY D. RALPH

DETAILED INFORMATION on the field prices of natural gas in all principal producing areas of the United States is now available for the first time.

It has been collected and analyzed in a $200,000 special study financed by nine independent producers and submitted to the Federal Power Commission for use in determining prices to be fixed in interstate contracts for any producer.

What FPC will do with the data remains to be seen.

The courts have told FPC that under the present law it cannot set producer prices on the basis of average field prices alone. The commission must first find actual cost of production and use that figure at least as a "point of departure." FPC may then consider other data bearing on the "just and reasonable price," including, if it chooses, going prices in the area of production.

The producers who sponsored this study hoped that FPC would give a great deal of weight to average prices now prevailing in the various areas. But present indications are that FPC, or at least its staff, is inclined to attach very little, if any, importance to existing field prices.

Of course, if the pending Harris-O'Hara bill becomes law, FPC will be directed to drop its obsession with costs and to determine reasonable field prices based on a number of other factors including market values and prevailing prices in the vicinity of production. If that happens, this costly study will prove of great value to all producers.

In the meantime, the study may remain just another research project.

As such, however, it contains a great deal of information never before compiled. It goes a long way toward answering many questions and settling many arguments about the prices and terms of contracts for natural gas delivered to interstate pipelines. It may become valuable reference material for many future studies.

There is no such thing as "the" price of gas at the wellhead, it is obvious from studying the compilation. There are five principal factors which have an influence on the price:

... Date of contract.
... Distance from consumer markets.
... Volume of reserves committed.
... Term of the contract.
... Quality of the gas.

In addition, long-term contracts normally do not specify a single price but rather a "bundle" of definite and indefinite price provisions, the composite of which is the price consideration. Typically there is the initial base price, the price per M.c.f. being delivered at any given date, and the weighted-average base price over the duration of the contract.

The average base price is probably the most representative of the market value of gas at the time the contract was made.

How the survey was made

THIS FIELD-PRICE SURVEY is on file with FPC as a huge exhibit in Docket G-9277, et al., the so-called "omnibus case" in which FPC temporarily consolidated price investigations involving Champlin, Pan American, Continental, Atlantic, Humble, Sinclair, Tidewater, Western Natural, and C. V. Lyman.

The work was done by the consulting firm of J. Rhoads Foster & Associates. FPC staff members checked the figures and certified as to the accuracy of the basic data—though not necessarily agreeing with any conclusions drawn from the figures.

The Foster crew examined all producer contracts dated since December 31, 1952, and filed with the FPC up to June 30, 1957. (Filing, of course, does not mean FPC approval). The data were punched onto machine-tabulation cards for analysis, and then tabulated into two huge volumes now on public file with FPC.

Later Dr. Foster and other expert witnesses for the companies sponsoring the study analyzed the figures in various ways and drew a variety of conclusions from them—all of which met a cool reception from the FPC staff. Some of Dr. Foster's charts and analyses are the basis for this article.

Field Prices of Gas

	Pressure base psia.	Average Base Price (¢/M.c.f.)	
		Contracts filed before June 30, 1956	Contracts filed after June 30, 1956
Mississippi	15.025	21.2	21.7
South Louisiana	15.025	17.6	19.7
Houston area	14.65	12.9	13.7
Goliad area	14.65	11.8	13.0
Corpus Christi area	14.65	12.3	14.4
North Louisiana and East Texas	14.65	12.7	13.9
North Texas and Oklahoma, except Hugoton	14.65	10.9	12.9
Kansas, except Hugoton and vicinity	14.65	12.4	14.2
Hugoton-Panhandle areas of Kansas, Oklahoma, and Texas	14.65	12.8	15.7
West Texas and Southeast New Mexico	14.65	11.5	12.0
Four Corners area	14.65	12.1	13.7
Rocky Mountain areas	14.65	11.5	11.5

"Average base price" is an average of the separate prices (including escalations) specified in the contract base price schedule over the duration of the contract, weighted by the number of months scheduled to be effective.

All contracts were dated 1953 or later and have been accepted by FPC for filing as independent producer rate schedules.

THE TABLE above shows the average base price of gas in principal producing areas, under contracts of 20 years or longer, made with interstate pipelines since January 1953. The listing includes sales of plant residua gas, but not gas for processing (that is, where no separate payment for liquids is indicated).

The average base price in this table is a simple arithmetic average of the year-by-year prices contemplated by the definite price provisions of the contract (that is, fixed escalations). It does not include possible increases under so-called indefinite pricing provisions such as renegotiations, favored-nation clauses, or spiral escalations.

The figure is not weighted as to quantity of gas delivered under each change of price, and so gives equal weight to higher prices to be paid in later years and to the lower prices to be paid in early years. The totals of individual contracts grouped by areas are also simple arithmetic averages, and are not weighted as to volume of gas covered.

In spite of all these qualifications, this table is very revealing. For the first time it gives what may be considered representative field prices, by areas, for long-term contracts. The average base price may not be exactly the true market value of the gas, but it approximates what individual buyers and sellers considered it to be at the time they made their contracts.

This table provides valuable reference points for any discussion of field prices for gas and the factors that influence them.

•

THE RELATIONSHIP between the average base price used in the table. and the beginning and ending prices specified in the contracts is illustrated in the graph below.

This covers only the 20-year contracts made in the Houston area during 1955 and 1956.

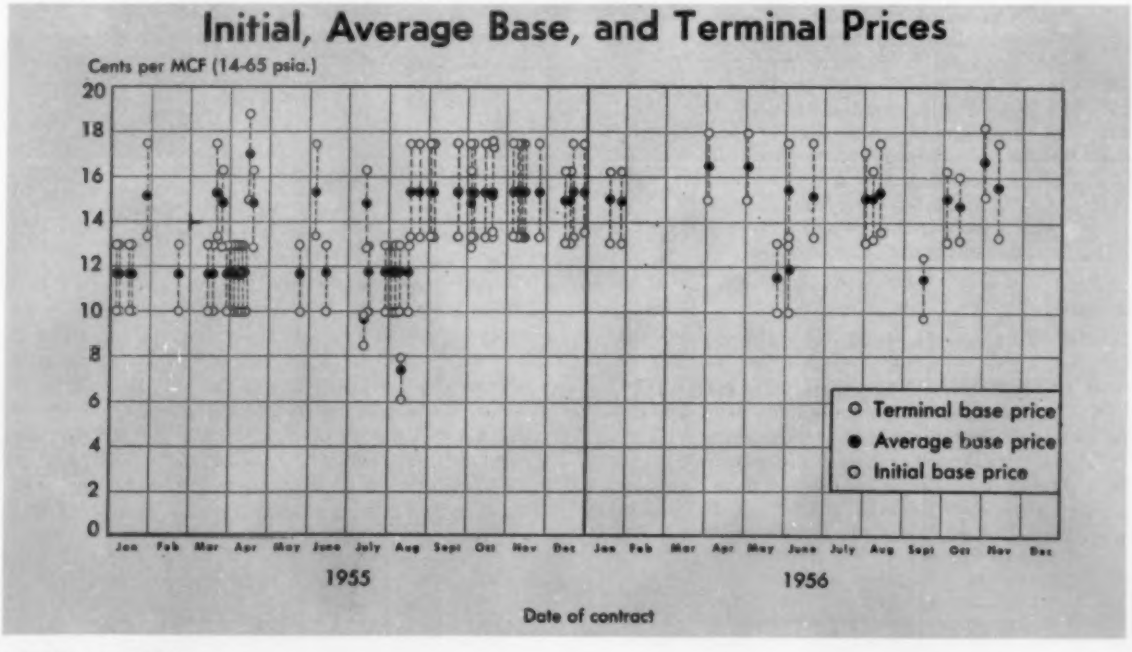
Three things may be noted from this illustration:

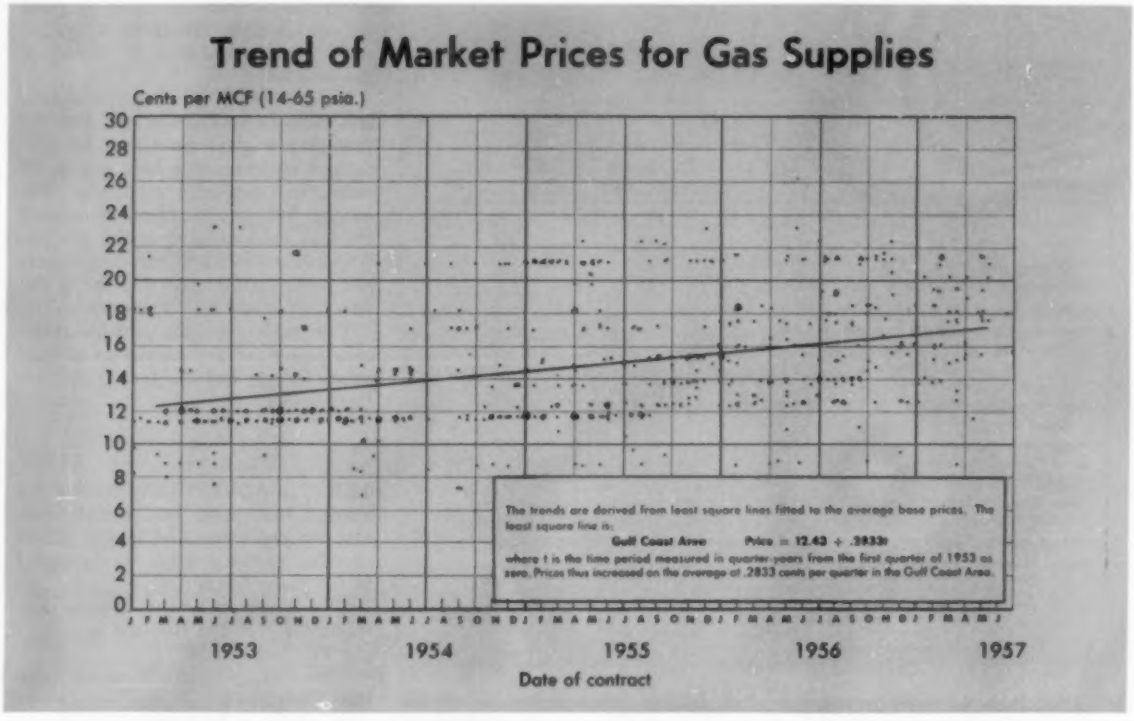
. . . The average base price is usually a shade above the midway point between the low initial price and the high final price;

. . . The spread between bottom and top prices is usually in the range of about 4 cents per M.c.f.

. . . Most of the more recent contracts are very close to the range which appears to have become established about the middle of 1955.

Initial, Average Base, and Terminal Prices





THE SOLID LINE across this "fly-speck" chart shows the upward trend of prices paid by interstate pipelines for new gas supplies in the Gulf Coast area from the beginning of 1953 to the middle of 1957.

Each dot represents a pipeline dedication, and the price indicated is the average base price. The trend line was plotted by a quarterly "least squares" formula.

It is interesting to note that, while the average of all field prices in this area has moved steadily upward, in almost every month of the period covered some contracts were written at down around 8 cents per M.c.f. while some were about 22 cents.

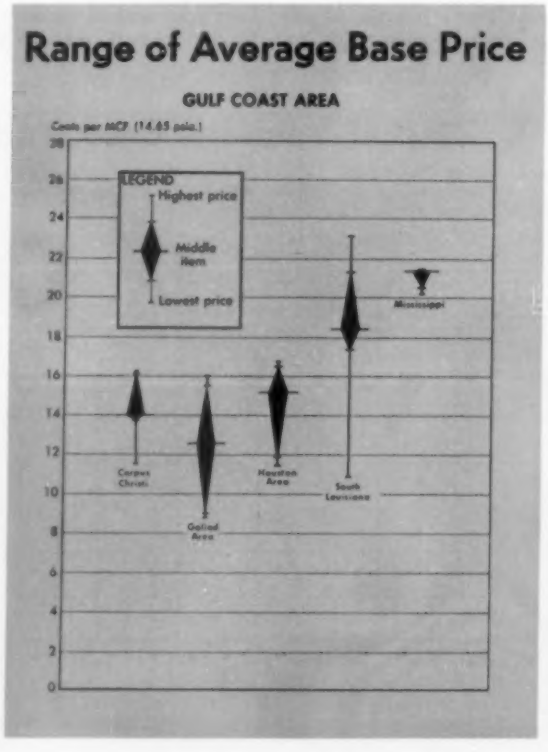
THE ODD-SHAPED "lozenges" on this chart reveal a different aspect of the behavior of gas field prices—variations in the spread between high and low contracts in different producing areas.

This particular study is an analysis of the contracts written during 1956 and the first half of 1957 in five Gulf Coast areas.

Note that in Mississippi the range is very narrow and that there is only a minute difference between the median price and the whole 50 per cent of all contracts carrying a price higher than the median.

In South Louisiana, on the other hand, the spread is very great, and the 10 per cent of contracts with low prices are far below the middle price figure while the 40 per cent below the middle are not far below the median price.

The chief value of this chart is to demonstrate that the range of prices in a given area is less indicative of prevailing field prices than the number of contracts grouped near a particular portion of the price range.



HERE'S a very interesting study showing how field prices are affected by distance from the pipeline's principal markets.

It is based on the average base prices, weighted by delivery volume, in contracts made in five Gulf Coast areas during 1956 and the first half of 1957. It takes South Louisiana as a basing point and assumes that it costs 1.25 cents per M.c.f. to transport gas 100 miles.

The main markets for this gas are to the northeast, so theoretically fields farther south and west should have prices lower than the basing point by amounts related to the additional distance from the markets.

The chart indicates that this is roughly the case, but not entirely so. The Mississippi price is right on the button when allowance is made for its transportation advantage over South Louisiana. The Goliad and Houston areas are slightly underpriced by this method of evaluation, while Corpus Christi gets more than it would seem to be entitled to on the basis of location alone.

It must be remembered that distance from market is only one of the many factors that influence field price. The time that the contract is made, the number of pipelines competing to purchase uncommitted reserves, and the several other factors covered in this series of charts all have a bearing on the field price.

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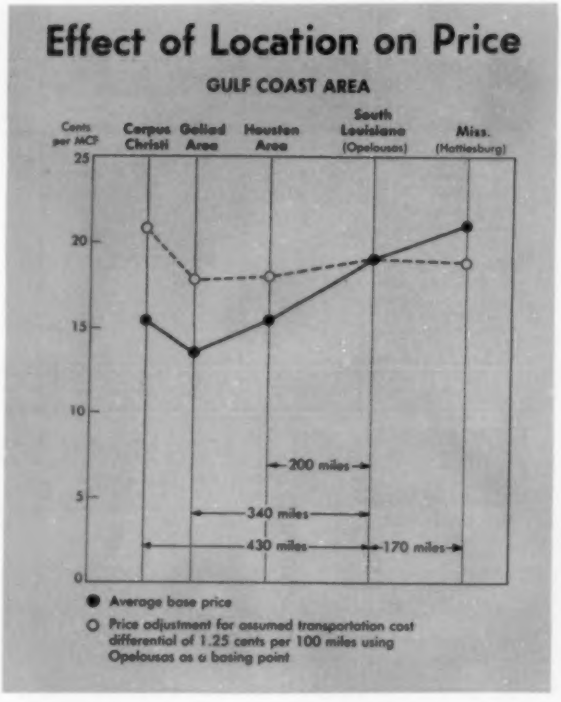


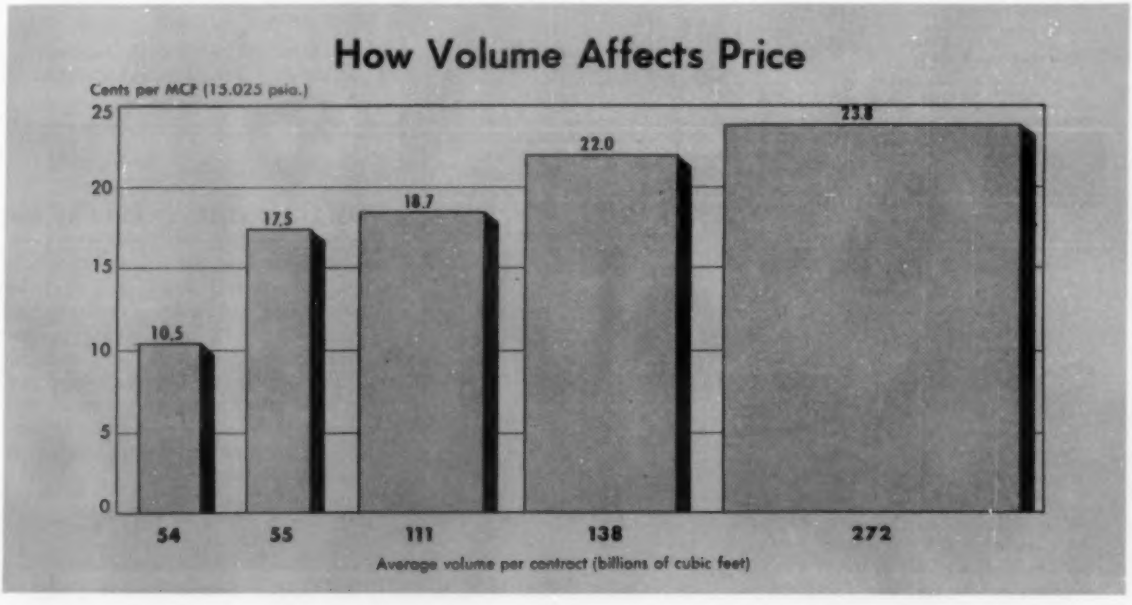
A FACTOR commonly overlooked in pipeline contracts is that the bigger the volume the higher the price—quite the opposite from the usual concept of quantity discounts.

This, of course, is due to the fact that it is expensive to run feeder lines to pick up small dabs of gas; so it is economical for a pipeline to pay more per M.c.f. if it can get a very large part of its supply from a single concentrated area.

This chart shows how this has worked out in a typical area. It shows the volumes of gas committed at specific average base prices in 112 long-term contracts made in South Louisiana between May 1952 and June 1956.

This is a double-edged chart. On the one side it suggests that a pipeline won't pay more than 10.5 cents per M.c.f. if it can't get any more than 54 billion cubic feet dedicated to it by a single contract, but will go as high as 23.8 cents if it can get as much as 272 billion of reserves at one whack.

On the other side it suggests that a producer won't dedicate large reserves if the price is down around 10 cents, but if he is offered something above 20 cents he will go all out in committing all the gas he has or thinks he can find.



B.T.U. CONTENT	No Minimum Specification	Minimum Btu Content Accepted Without Penalty: Below 1,000	Minimum Btu Content Accepted Without Penalty: 1,000 and above	Credit for Excess Btu Content	Penalty for Low Btu Content
GULF COAST AREA:					
Mississippi	...	24	2	...	...
South Louisiana	1	...	69	...	58
Houston Area	2	...	23	...	18
Golfad Area	3	1	36	...	17
Corpus Christi Area	...	...	40	...	28
Total	6	25	170	...	121
MID-CONTINENT AREA:					
North Louisiana and East Texas	28	14	35	...	13
North Texas and Oklahoma Except Hugoton and Vicinity	4	1	54	3	48
Kansas Except Hugoton and Vicinity	5	...	40	...	38
Hugoton-Panhandle and Vicinity	32	17	73	35	88
West Texas and S. E. New Mexico	3	1	56	...	3
Total	72	33	258	38	190
Total Southwest	78	58	428	38	311

SULFUR CONTENT	No Limit Specified	Hydrogen Sulfide Limit (gr./100cf): 0 to 0.5	Hydrogen Sulfide Limit (gr./100cf): 0.51 to 1.0	Hydrogen Sulfide Limit (gr./100cf): Over 1.0	Sulfur Limit (gr./100cf): 0 to 10.0	Sulfur Limit (gr./100cf): Over 10.0	Penalty for Sour Gas (¢/Mcf): 0 to 0.5¢	Penalty for Sour Gas (¢/Mcf): Over 0.5
GULF COAST AREA:								
Mississippi	...	1	25	...	1	25	...	...
South Louisiana	...	23	40	7	12	58	...	3
Houston Area	...	4	21	...	4	21	...	...
Golfad Area	8	2	30	...	1	31	...	...
Corpus Christi Area	...	...	40	...	...	40	...	...
Total	8	30	156	7	18	175	...	3
MID-CONTINENT AREA:								
North Louisiana & East Texas	...	1	62	14	...	77	...	...
North Texas & Oklahoma Except Hugoton and Vicinity	2	8	49	...	1	56	...	...
Kansas Except Hugoton and Vicinity	1	10	34	...	10	34	5	...
Hugoton-Panhandle and Vicinity	5	27	89	1	5	112	30	...
West Texas and S. E. New Mexico	1	59	...	...	57	2	...	...
Total	9	105	234	15	73	281	35	...
Total Southwest	17	135	390	22	91	456	35	3

WATER CONTENT	No Minimum Specified	Seller Dehydrates to (#/MMcf): Below 6.1	Seller Dehydrates to (#/MMcf): 6.1 and Above.	Buyer's Specifications	Payment by Purchaser (¢/Mcf) .20 to .25¢	Payment by Seller (¢/Mcf) .20 to .25¢
GULF COAST AREA:						
Mississippi	...	1	25	...	...	...
South Louisiana	6	35	29	...	...	...
Houston Area	5	...	20	...	2	7
Golfad Area	31	1	8	...	...	...
Corpus Christi Area	5	5	30	...	6	3
Total	47	42	112	...	8	10
MID-CONTINENT AREA:						
North Louisiana and East Texas	37	...	40	...	...	...
North Texas and Oklahoma Except Hugoton and Vicinity	45	...	2	12	...	*18
Kansas Except Hugoton and Vicinity	45	...	...	...	...	...
Hugoton-Panhandle and Vicinity	119	...	2	1	...	...
West Texas and S. E. New Mexico	3	...	57	...	...	...
Total	249	...	101	13	...	18
Total Southwest	296	42	213	13	8	28

*Over 25 cents.

DELIVERY PRESSURE	No Maximum Specified	Seller's Maximum Obligation (psia): 800 and below	Seller's Maximum Obligation (psia): 801 to 1,100	Seller's Maximum Obligation (psia): Above 1,100	Charge or Penalty for First Stage of Compression (¢/Mcf): 75¢ and below	Charge or Penalty for First Stage of Compression (¢/Mcf): Above .75¢	Compression Cost
GULF COAST AREA:							
Mississippi	...	...	26	...	...	...	...
South Louisiana	1	...	64	5	...	...	14
Houston Area	...	5	20	...	...	...	...
Golfad Area	3	1	17	19	...	14	1
Corpus Christi Area	...	...	39	1	...	1	...
Total	4	6	166	25	...	15	15
MID-CONTINENT AREA:							
North Louisiana and East Texas	15	27	35	...	34	1	1
North Texas and Oklahoma Except Hugoton and Vicinity	7	52	...	...	...	26	6
Kansas Except Hugoton and Vicinity	9	35	1	...	...	17	...
Hugoton-Panhandle and Vicinity	91	13	18	...	...	6	...
West Texas and S. E. New Mexico	2	54	4	...	1	...	54
Total	124	181	58	...	35	50	61
Total Southwest	128	187	224	25	35	65	76

Contracts provide for charge of actual cost of compression plus 6 per cent, up to a maximum of 2 cents per Mcf.

Gas Quality Affects Its Price

NATURAL GAS isn't "just plain gas." Its quality may vary quite considerably. Discriminating buyers take note of quality in evaluating a price, and pipelines are becoming quite discriminating. They sell their gas under rather exacting specifications, so in purchasing they often give a premium for top-grade gas and quite frequently penalize a seller if his gas requires extra compression or some sort of treatment to bring it up to specification.

These price premiums and penalties are difficult to summarize in average cents per M.c.f. But this table gives a good indication of the degree to which quality specifications enter into price considerations.

It is a tabulation of the numbers and types of specification clauses in 564 relatively recent long-term contracts for interstate transmission. It covers the four most important quality factors: B.t.u. (heat content) of the gas; sulfur content (degree of sourness); water content (necessity for dehydration); and the gas pressure at point of delivery to the pipeline.

The obvious feature of this table is the wide variety and general use of quality specifications—each one of which may have an important bearing on whether the price received by a producer is above or below the average field price in his area or in some other area.

SO, THESE CHARTS REVEAL, the price of gas is a combination of a lot of things—time, place, quantity, quality, and contract terms. And there is no formula for equating them against each other and coming up with a specific figure on what the field price is.

But this study should go a long way in eliminating some of the misunderstandings about gas prices and in providing a reference base for discussion and comparisons.

Questions and answers that will bring you up to date on the technology of . . .

Natural-Gas Pipelining

This "refresher course" is based on technical developments, methods, and procedures reported in Journal articles in 1957

1. Construction

Q. What are the chief causes of pipe failure?

A. A starter stress point such as a gouge, scratch, weld arc burn, or other surface damage. The rupture pictured here was the result of gouges by the coating and wrapping machine. **OGJ, Sept. 16, 1957, p. 162.**

Q. What is the result of ovality of pipe?

A. When roundness tolerance is exceeded, cracked stringer beads and mismatched or high-low welds. They are rejected and cut out of the line at considerable expense. **OGJ, Sept. 16, 1957, p. 162.**

Q. When does ovality occur and how may it be eliminated?

A. Mills say that it occurs during shipment. Companies claim that it occurs at the mill. Tests by one company indicated ovality before shipping from the mill. Mills say that internal expanding devices used in the field can cure ovality. Companies say that to eliminate ovality the ends of the pipe must be stretched beyond the yield point, and that no internal lineup clamp can do this. **OGJ, Sept. 16, 1957, p. 162.**

Q. What are the principal characteristics of the newly developed mechanized welding procedure?

A. There is no preheating even at very low temperatures. There is no stringer bead or hot pass preparatory to submerged-arc welding. An operator runs a bead inside the pipe following the running of outside beads. The beveled end of the pipe is ground to make a shorter, thicker land. Pipe is butted together tight during lineup without spacing. **OGJ, April 22, 1957, p. 104.**

Q. What is the significance of mechanized welding to pipeline construction?

A. It can speed construction in fairly flat country that is favorable for double jointing. Production could be increased as much as 50 per cent with benefits accruing both to the pipeline owner and the contractor. **OGJ, April 22, 1957, p. 104.**

Q. How much does it cost to lay 30-in. pipe?

A. The cost varies from $2.90 per foot for actual construction in prairie country to $16 per foot in solid rock. **OGJ, Dec. 9, 1957, p. 65.**

PAINT-MACHINE GOUGES caused this pipe rupture.

OPERATOR merely guides welding head.

Q. Where is an erosion-control dam located in relation to the pipeline and what is its function?

A. The dam is located downslope from the pipeline. It checks the extension of a deep unstable gully which otherwise would cut its way uphill to undermine the pipeline. The dam is built just above the upper end of the gully. **OGJ, Dec. 9, 1957, p. 98.**

Q. When should erosion control be started?

A. One company recently changed its policy to include erosion mitigation as part of the initial construction program rather than leave the job to maintenance personnel later. Its plan is to prevent any gully from working uphill within 200 ft. of the pipeline. **OGJ, Dec. 9, 1957, p. 98.**

Q. What determines whether a stream is spanned by a suspension bridge or submarine line?

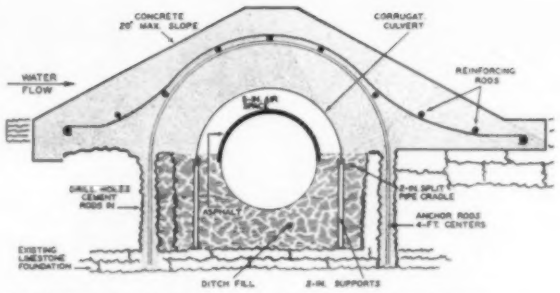
A. Submarine lines are generally used. A suspension bridge, because of its high cost, is confined generally to deep gorges with stable banks which make buried lines difficult if not impossible to lay with permanency. A suspension bridge, besides requiring more time to construct, is also subject to damage from high winds and flying objects, is costly to maintain, and is fully as vulnerable to damage from caving banks as underwater lines. **OGJ, July 1, 1957, p. 107.**

Q. What are the considerations in designing a river crossing?

A. The effects of buoyancy, stream currents, stream turbulence, scour and fill of the stream bed, bank recession, debris and sand movement, temperature changes, anchoring of boats, dredging, corrosion, and attack by marine organisms. **OGJ, July 15, 1957, p. 96.**

Q. How may pipe buoyancy be overcome at a crossing?

A. By weighting with various methods: increasing the thickness of the pipe, attaching concrete or steel weight clamps; or by continuous coatings such as heavy aggregate concrete. **OGJ, July 15, 1957, p. 96.**



CONCRETE ARCH guards pipe from flood damage at stream crossing.

Q. How may a pipeline be protected at an exposed stream crossing subject to flash flooding?

A. It was done this way on a 24-in. line: A concrete arch was constructed across the pipe. Boulders or other material could impinge against the pipe without damaging it. This method was used because the original ditch across the stream bed was blasted out of limestone. With hills rising sharply on both sides of the streams, it was impractical to get slack or lower the line. **OGJ, Oct. 21, 1957, p. 141.**

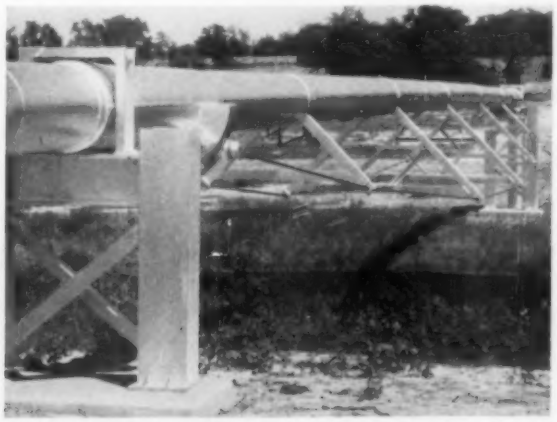
Q. What is the function of the trusses and cables shown in the overhead span pictured below?

A. The span shown is specially designed by Natural Gas Pipeline Co. of America for crossing wide creeks. The series of trusses supported on two heavy cables in tension holds the pipe in compression. Movement of the pipe span would be restrained by the frame at the top of the tower at each end of the span. **OGJ, Dec. 16, 1957, p. 134.**

Q. What are some of the problems arising from unstable soil along the Gulf Coast?

A. It may result in excessive vertical displacement of a pipeline. Two possible preventive measures: during construction fill pipe with water, jet ditch, backfill, then permit time for rehealing of soil before removing water; use heavier pipe and backfill. **OGJ, Sept. 16, 1957, p. 151.**

PIPE LAUNCHER controls slope of pipe.



CABLES AND TRUSSES hold pipe in compression.

Q. What are the two major hazards in offshore construction relating to actual laying of the pipe from barges?

A. Cracking the concrete weight coating and buckling of pipe through excessive bending. Various devices are employed as safeguards: There are buoys attached to pipe, inclined launching ramps, and launchers which change their slope as required by controlling buoyancy. **OGJ, Nov. 4, 1957, p. 154.**

2. Supercharging

Q. What is involved in supercharging?

A. Getting more combustion air and fuel gas into the cylinder, conditioned in such a way to result in smooth, detonation-free combustion. **OGJ, June 24, 1957, p. 161.**

Q. How is supercharging accomplished?

A. Natural Gas Pipeline Co. of America removed the entire exhaust line and muffler, replaced it with individual 6-in. exhaust lines for each power piston. The lines were direct connected to the exhaust turbine. Exhaust gases go from the turbine to the reused muffler nearby. The pulse-type turbine on the exhaust is coupled to the air-intake turbine to increase air pressure to a maximum of 5 psig. Fuel gas to the power cylinder was increased to 25 psig. New cams increase intake and exhaust-valve overlap. The scavenging thus created improved combustion. **OGJ, Oct. 7, 1957, p. 144.**

Q. What is the economic advantage of supercharging two-cycle engines?

A. Engine capacity can be increased as much as 25 per cent, and maximum capabilities of the engine sometimes as much as 50 per cent. This has been accomplished by supercharging conventionally scavenged engines at a cost per base horsepower of only 31 to 40 per cent of original installation cost. **OGJ, June 21, 1957, p. 160.**

Q. How does supercharging affect fuel consumption?

A. Supercharged-engine requirements are 7.5 cu. ft. of 1,023-B.t.u. gas per horsepower-hour compared with a maximum fuel economy of 9.5 cu. ft. per horsepower-hour for regular units. **OGJ, Oct. 7, 1957, p. 144, and Aug. 5, p. 77.**

Q. What is the effect of ambient air temperature on combustion characteristics of two-cycle engines operating without scavenging-air cooling equipment?

A. A reduction of ambient air temperature from 108° to 92° F. increased by 10 per cent the gas horsepower load at which detonation occurred. **OGJ, June 24, 1957, p. 161.**

Q. Does supercharging cause exhaust temperatures to increase?

A. No. Improved scavenging functions to keep the jacket-water cooling load about the same as before. **OGJ, Oct. 7, 1957, p. 144.**

Q. When was turbocharging of two-cycle engines begun?

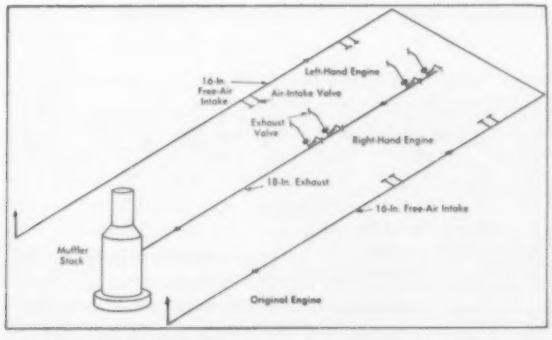
A. Development work dates back to 1951. The first conversion to all-exhaust turbocharging of two-cycle gas engines was December 1953 by Tennessee Gas Transmission Co. This was the first turbocharged two-cycle engine on a gas pipeline in the United States. **OGJ, Mar. 11, 1957, p. 164.**

Q. How long does turbocharging of four-cycle engines date back?

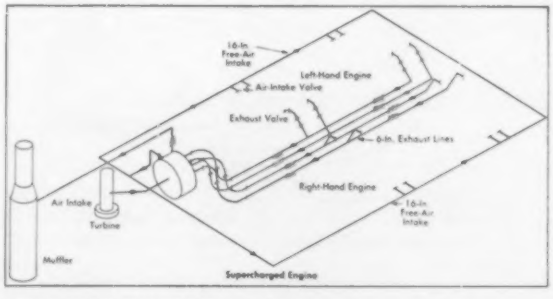
A. The practice started in 1934. **OGJ, Mar. 11, 1957, p. 164.**

Q. Why is it important to purge a two-cycle engine's scavenging air and exhaust system with air before turning the ignition switch to firing position during engine startup?

A. Without purging, any gas which might have leaked into the power cylinders and out into the scavenging air and/or exhaust system while the engine was down will ignite the instant the ignition fires. **OGJ, June 24, 1957, p. 161.**



BEFORE SUPERCHARGING—original engine is shown.



AFTER SUPERCHARGING—modifications are shown.

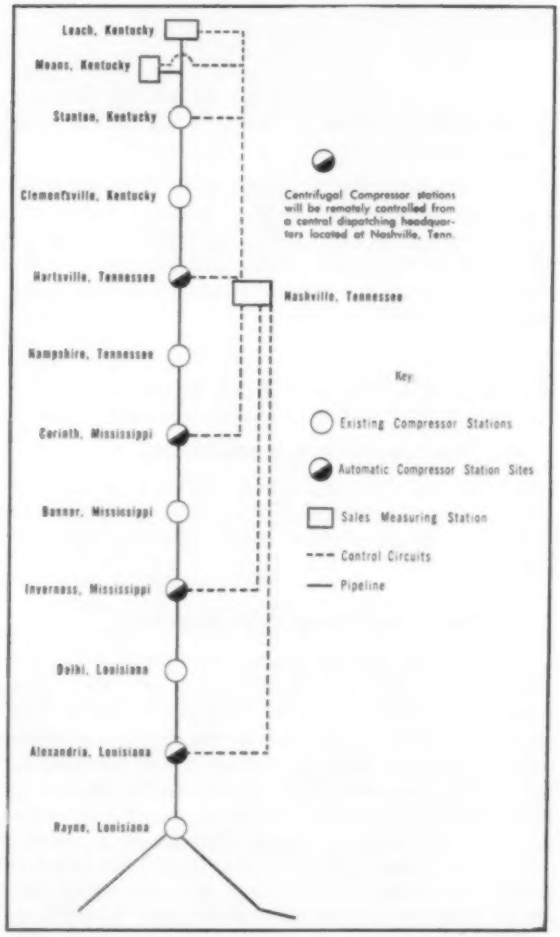
3. Automation

Q. Supervisory control may increase the efficiency of a natural-gas pipeline system in what ways?

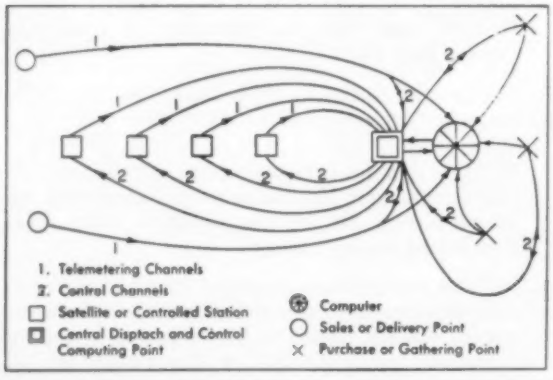
A. A computer system at a central control point can be continuously fed the various system pressures, flows, and other information related to dispatching. The equipment will continually supply the dispatcher with accurate information, which, in turn, will be transmitted back to the plants and various equipment in the system. In this type of installation the company will retain a full plant operating staff to accomplish station maintenance and general operating duties. The company will simply move the control to a central point where modern computers can recognize a dispatching problem instantly and utilize the complicated system facilities to the best advantage. **OGJ, June 3, 1957, p. 115.**

Q. System-wide control or partial control—which is desirable?

A. This type of installation can be made on a system basis, or in some cases, it might be economical to consider only part of the system. Sometimes small areas of a pipeline system are faced with constantly changing conditions of operation, such as those found in gathering systems. In this instance, a central control point can monitor, control, start, and stop satellite units from the main-line plant. This limited phase is now under study at El Paso Natural Gas Co. and will more than likely be its starting point on supervisory control. **OGJ, June 3, 1957, p. 115.**



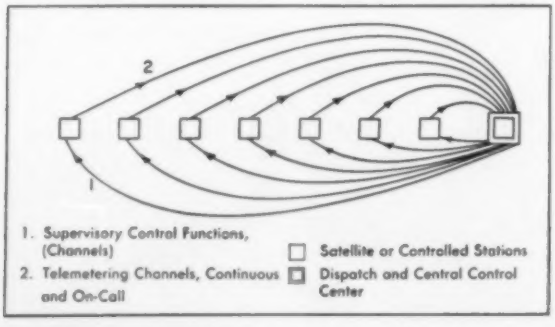
AUTOMATIC BOOSTERS are remote controlled on Gulf Interstate system.



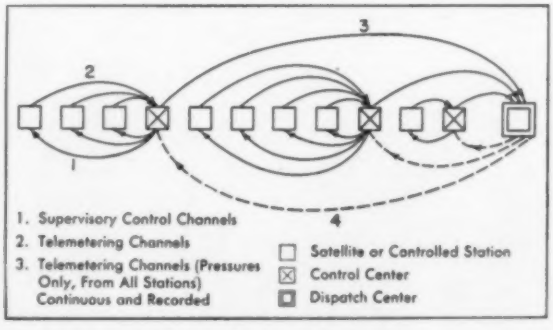
FUTURE AUTOMATIC PIPELINE has feedback loops through computer.

Q. What are some of the problems of automation?

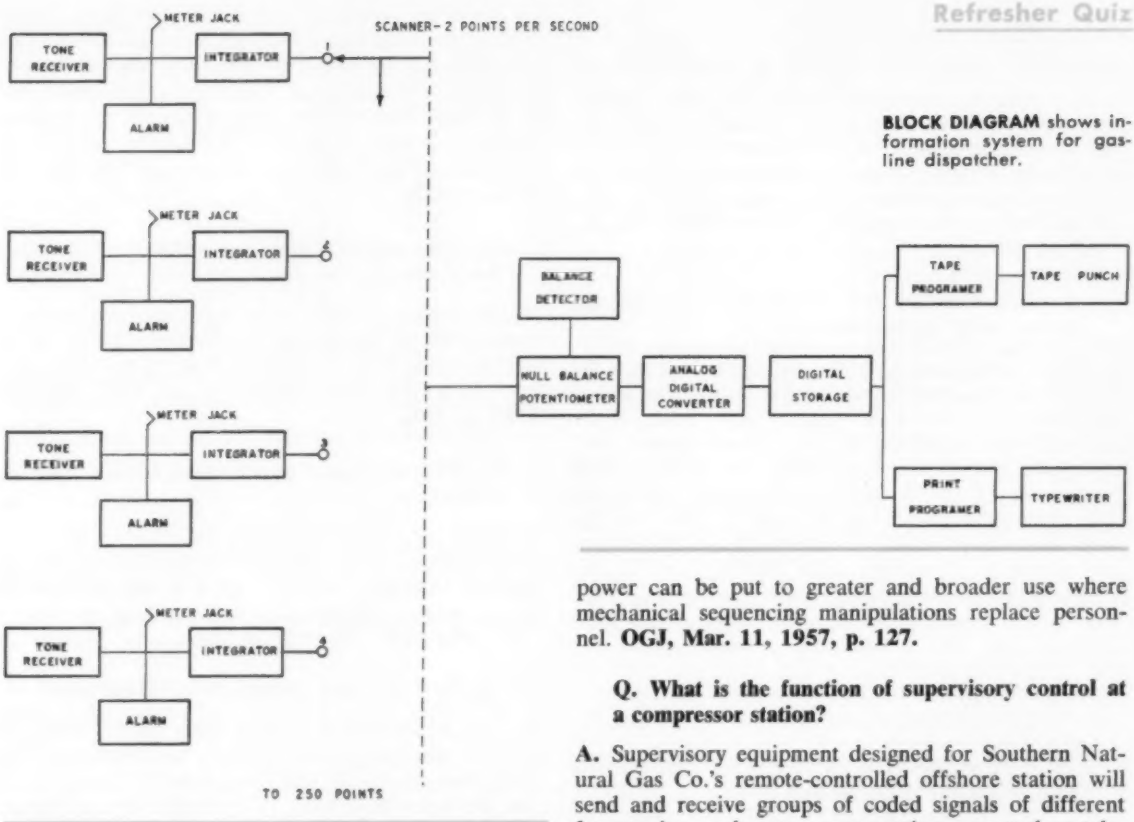
A. Serious problems are finding skilled personnel to fill newly created positions in feedback systems, computers, and instrumentation; adapting automatic operation to existing plants, which is generally difficult if


1. Supervisory Control Functions, (Channels)
2. Telemetering Channels, Continuous and On-Call
Satellite or Controlled Stations
Dispatch and Central Control Center

CENTRALIZED CONTROL from one point is shown.


1. Supervisory Control Channels
2. Telemetering Channels
3. Telemetering Channels (Pressures Only, From All Stations) Continuous and Recorded
Satellite or Controlled Station
Control Center
Dispatch Center

LOCALIZED CONTROL within a section is shown.



BLOCK DIAGRAM shows information system for gas-line dispatcher.

not uneconomical and unsuitable; and much basic instrument development remains to be done to attain reliable, accurate, sensing instruments essential for control. **OGJ, Mar. 11, 1957, p. 127.**

Q. What are some of the benefits of automation?

A. Automation opens unlimited possibilities for conditioning and transporting natural gas with greater safety, increased dependability, and lower transmission costs. Its gains are already evident in automatic dehydration, desulfurization, and stripping plants for gas conditioning. Many automatic measuring stations and field booster compressor stations are in operation. The next major step is automatic main-line compressor stations controlled from a central location. **OGJ, Mar. 11, 1952, p. 127.**

Q. Automatic compressor stations have what benefits?

A. Some advantages are automatic handling of information at and from compressor stations increases the versatility of the pipeline so that it can be kept at high performance levels; the judgment of sensing instruments can be made infallible (while the human judgment it replaces is not infallible), resulting in stations that are safer; unit transportation cost of gas can be reduced; information required to change or stabilize line-pack conditions is immediately available for the dispatcher's use; any upset at compressor stations can be instantaneously noted by the dispatcher and corrective actions initiated without delays; available manpower can be put to greater and broader use where mechanical sequencing manipulations replace personnel. **OGJ, Mar. 11, 1957, p. 127.**

Q. What is the function of supervisory control at a compressor station?

A. Supervisory equipment designed for Southern Natural Gas Co.'s remote-controlled offshore station will send and receive groups of coded signals of different frequencies, each group representing a control or telemetering function. The portion of the equipment at the platform compressor station will measure, decode, and transmit the electrical impulses to the control panels which in turn actually control the engines and valves. The engine will be started or stopped with the transmission of one group of coded tone signals. **OGJ, Sept. 16, 1957, p. 205.**

Q. Automatic data handling aids dispatching in what ways?

A. In the case of the Charleston Group Companies of the Columbia Gas System the gas dispatcher formerly received 250 bits of data each hour by telephone. He had to log each item and make computations. It was a time-consuming process requiring 40 minutes, leaving only 20 minutes out of each hour for actual dispatching. Newly installed instrumentation automatically collects data, reduces it to information, records it, and at the same time notifies the dipatcher of any change in the trend throughout the system. **OGJ, Sept. 16, 1957, p. 157.**

Q. The completely automatic pipeline has what principal characteristics?

A. It involves closed-circuit operation with feedback loops from gathering and sales points through a computer into the control device. The number of alarm and control functions transmitted between the control center and the controlled station will vary considerably, both as to type of compressor station involved and the desire of the company that operates them. In

general, the stations should have automatic operation within themselves as much as possible, with sequencing controls so that they may be started or shut down by means of one supervisory function. This automatic sequencing is quite simple on electric-motor-drive stations, more involved with turbine drive and quite complicated with reciprocating-engine drive. **OGJ, Oct. 21, 1957, p. 118.**

Q. How does the new Quadriphase multiplexing system work on microwave?

A. The quadriphase system is the result of a new approach to the synchronization problem. The system uses the sine wave as the simplest wave form. A single sine wave is phased into two waves exactly 180° apart. Each of these is then shifted 90° to obtain four sine waves of exactly the same frequency and phased into quadrature, hence quadriphased. With the four sine waves as a master timing signal, it is possible to use networks containing only resistors and a condenser to form a sine wave of any desired phase. Receivers are synchronized with the original sine wave and will shift with it. **OGJ, July 1, 1957, p. 161.**

4. Gas Conditioning

Q. What are the most commonly used gas-dehydration processes? How do they work?

A. Glycol (absorption) and solid-desiccant (adsorption) are the standard processes. Concentrated glycol solution flows countercurrent to the gas being dried down through the contactor and then through a heat exchanger to the regenerator where the water removed from the gas is distilled. The regenerated glycol solution is returned to the contactor for further use. At least two separate charges of desiccant are required for the adsorption process. While one charge is removing the water vapor from gas the other is being regenerated for use while the drying ability of the previous charge is exhausted. Desiccant regeneration may be accomplished by bypassing a part of the wet gas through a heater and then up through the tower countercurrent to the gas-drying direction. **OGJ, Apr. 29, 1957, p. 122.**

Q. What are the principal methods of wellhead dehydration in the San Juan basin?

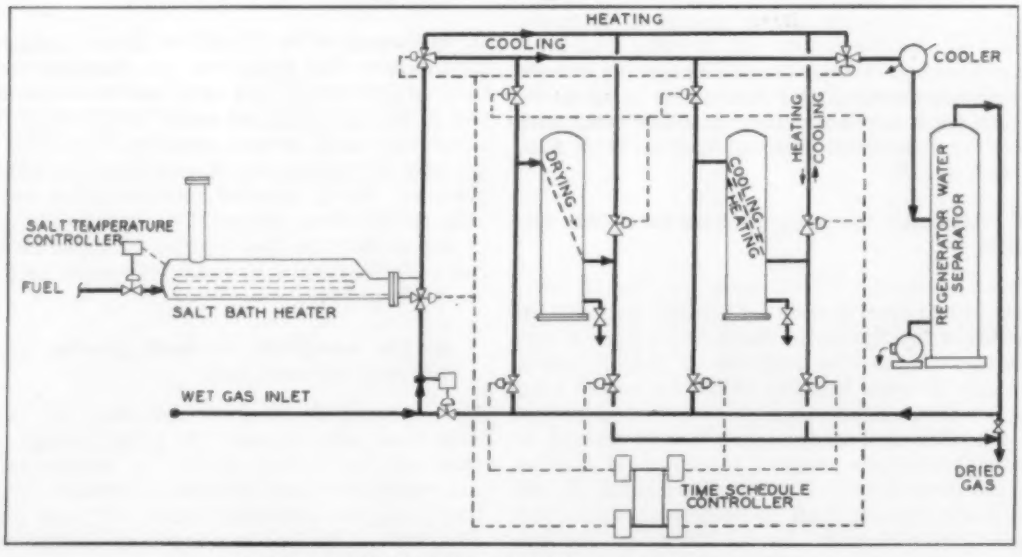
A. Absorption of water into glycol and absorption of water from gas by anhydrous calcium chloride pellets and the utilization of the brine thus formed through a series of trays to predehydrate the gas. **OGJ, Apr. 29, 1957, p. 188.**

Q. Why do many glycol units burn during the winter?

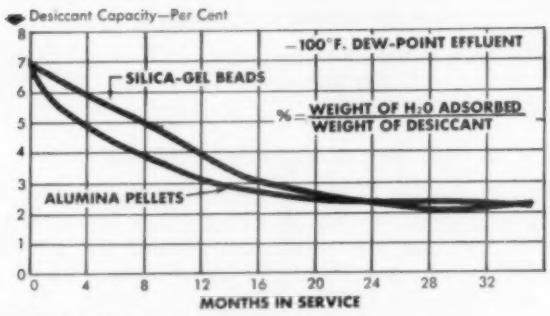
A. Fires are mainly the result of failure of the separators. This causes carryover of distillate to the dehydrator contactor column. Then it contaminates the glycol, reaches the reboiler, boils off, and ignites the unit. **OGJ, Apr. 29, 1957, p. 188.**

Q. How are fires prevented in glycol units?

A. The addition of drips and safety shutoff valves on the fuel-gas lines to the reboilers has eliminated fires that were caused by the condensation of distillate in the fuel-gas supply lines. The overloading of the glycol unit when placing shut-in wells on the line and the failure of the separator dump valves are the main causes of excessive glycol loss now being experienced. A new pump is being tested to use the return glycol from the contactor as a power medium. This will conserve the reservoir gas now being used to furnish energy for the circulation of the glycol through the contactor column. **OGJ, Apr. 29, 1957, p. 188.**



DEHYDRATION BY SOLID DESICCANT is one standard process.


Desiccant Capacity—Per Cent
100° F. DEW-POINT EFFLUENT
SILICA-GEL BEADS
% = WEIGHT OF H2O ADSORBED / WEIGHT OF DESICCANT
ALUMINA PELLETS
MONTHS IN SERVICE

DRYING CAPACITY decreases with age.

Q. What are the requirements of desiccants?

A. The goal is a material with higher per cent drying capacity resulting in less reactivation. The ideal desiccant has not been discovered as yet from the standpoint of removing all moisture for several years of operation. **OGJ, Oct. 28, 1957, p. 121.**

Q. What is the pattern of decrease in drying capacities of solid desiccants?

A. At Tennessee Gas Transmission Co.'s Gage, Ky., plant, drying capacities have decreased rapidly in the first few months of operation, then the decrease begins to level off. Solid desiccants in use at the plant are silica gel beads, alumina pellets, and activated bauxite. **OGJ, Oct. 28, 1957, p. 121.**

Q. What is a major cause of fouling of desiccant beds?

A. The major material causing contamination or fouling of beds at the TGT Gage plant was found to be heavy ends of light oil. The material contained 87 per cent paraffins, 12 per cent aromatics, and 1 per cent olefins. **OGJ, Oct. 28, 1957, p. 121.**

Q. What is the effect of desiccant-bed fouling?

A. It is twofold: It blocks the pores of the desiccant, closing off channels for water to enter. It also covers the surface of the desiccant, making it more difficult for water to reach the desiccant surface. Adsorption rate is slowed and fouling may also contribute to a slight increase in pressure drop through the beds. Part of the problem was the presence of a minute quantity of scrubber oil and lube oil in the gas stream. **OGJ, Oct. 28, 1957, p. 121.**

Q. What is the effect of dust from bauxite being carried by the gas stream through the trains of exchangers and into compressor cylinders?

A. It decreases heat-exchange efficiency, causes excess wear in cylinders. **OGJ, Oct. 28, 1957, p. 121.**

Q. What is the effect of pressure up to 2,000 psi. on the dew points of gas in equilibrium with aqueous glycol mixtures?

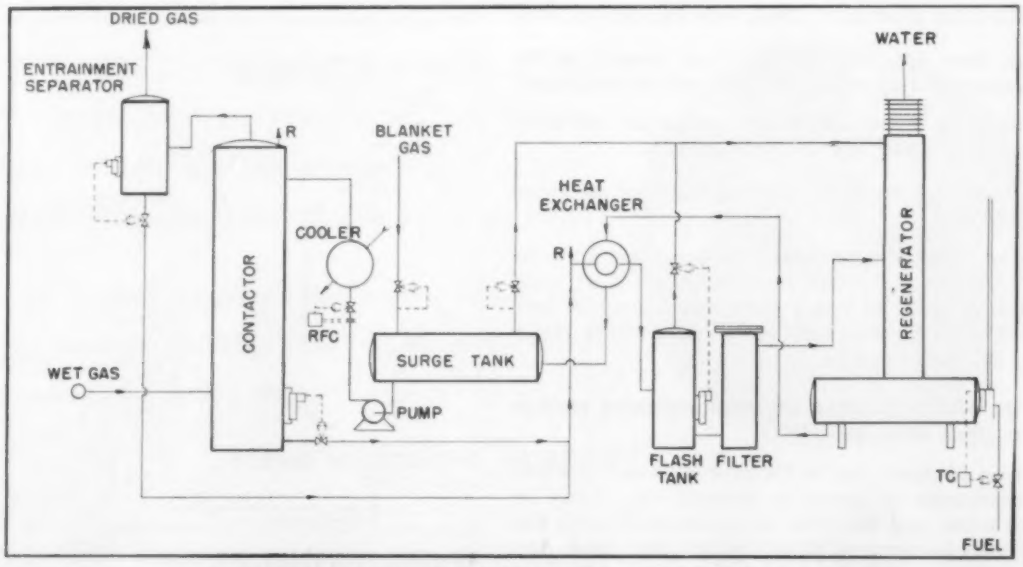
A. The effect has been found to be negligible. **OGJ, Sept. 23, 1957, p. 107.**

Q. What is the effect of thermal stability of glycols and absorbed hydrocarbons on the regeneration temperature?

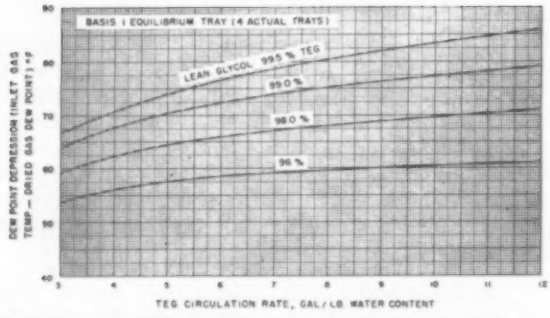
A. It limits the regeneration temperature in diethylene glycol systems to a maximum of 330°-350° F. and in the case of triethylene glycol to 350° to 375° or in some cases to 400° F. **OGJ, Sept. 23, 1957, p. 107.**

Q. What dew-point depression guarantees are offered by manufacturers?

A. Several guarantee a 65° depression or 7-lb. gas, whichever is first reached with a standard triethylene glycol plant and at least one company will guarantee a 75° depression for a nominal extra charge. Many



DEHYDRATION BY LIQUID DESICCANT is dominant method used.


BASIS 1 EQUILIBRIUM TRAY (4 ACTUAL TRAYS)
LEAN GLYCOL 99.5 % TEG
99.0 %
98.0 %
96 %
DEW POINT DEPRESSION (INLET GAS TEMP — DRIED GAS DEW POINT) °F
TEG CIRCULATION RATE, GAL/LB. WATER CONTENT

INCREASED WATER CONTENT reduces effect of circulation rate of dew-point depression.

standard-type glycol units consistently provide an outlet gas with water contents in the 4 to 7-lb. per M.M.s.c.f. range under average treatment conditions found in the field. **OGJ, Sept. 23, 1957, p. 107.**

Q. What high dew-point depressions have been attained and how?

A. Some glycol plants have consistently provided dew-point depressions in the 80°-100° F. range. These plants are able to secure unusually low-water-content solutions by regenerating the rich glycol solution under vacuum. **OGJ, Sept. 23, 1957, p. 107.**

Q. How are dew-point depressions in the range of 70° to 80° F. obtained in plants regenerating at atmospheric pressure?

A. They are obtained by introducing stripping gas into the reboiler. **OGJ, Sept. 23, 1957, p. 113.**

Q. What is the result of increased water content on the effect of circulation rates on dew-point depression?

A. Water content reduces the effect of circulation rate on dew-point depression. **OGJ, Apr. 29, 1957, p. 123.**

Q. How does reducing the water content of the regenerated glycol affect depression of dew points?

A. Reducing water content permits greater dew-point depressions. **OGJ, Apr. 29, 1957, p. 123.**

Q. What is the limit to drying ability of the glycol solution?

A. The extent of water removal is dependent upon the water content of the lean glycol solution. If we could regenerate glycol so that it had no water content there would be no apparent limit to its drying ability. **OGJ, Apr. 29, 1957, p. 123.**

Q. What is the most important operating problem in glycol dehydration?

A. Loss of glycol may be the most important problem. Contamination of glycol by hydrocarbons, finely divided solids, and salt water may promote foaming that will result in increased glycol consumption. **OGJ, Apr. 29, 1957, p. 125.**

Q. What are normal expected glycol losses?

A. They should be in the range of 0.2 to 0.5 lb. per M.M.s.c.f. of gas processed. **OGJ, Sept. 23, 1957, p. 113.**

Q. How may glycol losses be reduced?

A. By two steps: Precede the dehydration unit by an inlet separator to remove water, reduce hydrocarbons contaminating the glycol, and decrease the possible buildup of salt content; and use of a foam inhibitor. **OGJ, Apr. 23, 1957, p. 125.**

Q. Why does glycol solution become corrosive? What are some of the dangers?

A. Because of impurities in the gas being dried such as carbon dioxide and hydrogen sulfide. Entrained corrosive glycol has been known to cause pipeline blowouts as well as problems in the dehydration unit. **OGJ, Apr. 29, 1957, p. 126.**

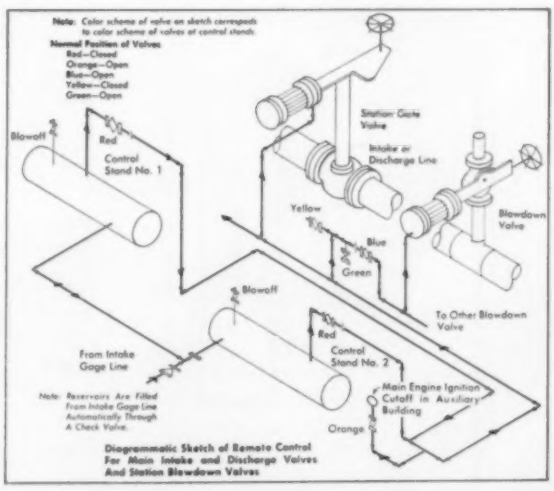
5. Compressors, Drives

Q. How do investment costs vary among electric motor, gas turbine, and engine drives for compressors?

A. Texas Eastern Transmission Corp. per horsepower costs are in this range: $114.04 to $215.50 for electric motor, $200 to $260 for gas turbine, and $250 to $300 for engines, the first two driving centrifugals and the latter driving reciprocating compressors. The 15,000-hp. motor with $114.04 investment is the lowest in the industry. Each drive is superior under certain operating conditions. **OGJ, July 22, 1957, p. 73.**

Q. What is the effect of cold temperatures on gas-turbine operations?

A. In cold weather the gas turbine reaches peak effi-



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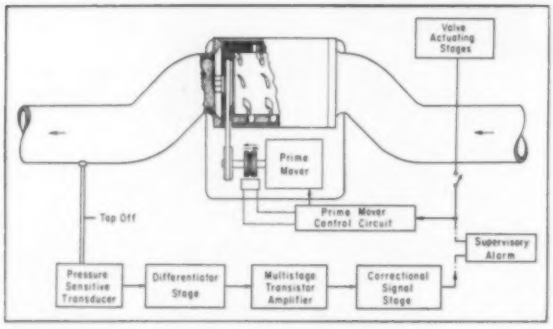


SURGE CONTROL is achieved by changing compressor load.

ciency (a 5,000-hp. turbine at one station develops 6,520 hp.). **OGJ, July 22, 1957, p. 73.**

Q. What are some of the advantages of centrifugal compressors?

A. High compression efficiency is available (the same is true of reciprocating compressors). Piping is simplified. The centrifugal lends itself more readily to automation than reciprocators. Maintenance is simple and lube-oil use is low. **OGJ, Mar. 11, 1957, p. 148.**

Q. What are some of the disadvantages of centrifugal compressors?

A. Surge, high-speed operation, and lack of experience in operating centrifugal compressors over widely changing gas loads. The centrifugal does not lend itself to packing the line, a very useful method of moving from minimum to maximum gas-delivery requirements, so gas-dispatching concepts must be changed. Personnel must be familiarized with new equipment. **OGJ, Mar. 11, 1957, p. 148.**

Q. How may surge be overcome?

A. A new surge-control device developed by Texas Eastern Transmission Corp. uses the feedback principle of control. A transducer watches the pressure variations at the discharge side of the station and transmits this to a device which goes into operation if this pressure starts to oscillate or "surge" and takes steps to control or eliminate the surge condition. This is done by gradually opening a recirculating or bypass valve to give the compressor more load, in the case of an electrical constant-speed unit, or in some cases reducing the speed of a turbine or other variable-speed drive if such is used. **OGJ, Oct. 21, 1957, p. 118.**

Q. What is the function of a remotely controlled blowdown system?

A. It releases gas trapped in a compressor station at a location of least hazard to prevent it from burning and damaging the station when there is piping or equipment failure. It should vent all the high-pressure gas in 1 minute or less at a selected remote point. **OGJ, Oct. 7, 1957, p. 144.**

Q. How may water consumption at a compressor station be reduced?

A. One company reduced consumption from 150,000 to 7,000 gal. per day by installing a closed cooling-water system. It also reduced treatment expense, sludge-disposal and corrosion problems. **OGJ, Oct. 7, 1957, p. 144.**

6. Corrosion

Q. Corrosion of buried pipelines is responsible for much of the maintenance cost of the pipeline in operation. Why does corrosion occur?

A. Corrosion usually occurs as the result of formation of galvanic cells along the line. A galvanic cell is set up when two dissimilar metals, separated by an electrolyte, are connected to a conductor. Or a cell may be formed when two similar metals are separated by dissimilar electrolytes and connected by a conductor. **OGJ, Mar. 11, 1957, p. 133.**

Q. What is the corrosion process?

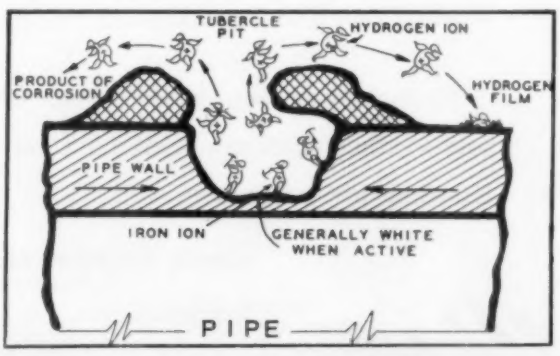
A. Pipe corrodes when current is permitted to flow from a point on the pipe surface (anodic area) through the soil (electrolyte) to another point on the pipe (cathodic area) of lower pipe-to-soil potential. **OGJ, Mar. 11, 1957, p. 133.**

Q. What is the function of a protective coating?

A. It prevents or mitigates corrosion by insulating the pipe and preventing the flow of current from the pipe. The current takes with it small particles of steel (ions) causing pits and eventually leaks in the pipeline. **OGJ, Mar. 11, 1957, p. 133.**

Q. What is the function of cathodic protection on a pipeline?

A. Current is impressed upon the pipe from rectifiers or buried sacrificial anodes. The flow of current onto the line keeps the galvanic cells inoperative and prevents the destructive flow of current away from the pipe. **OGJ, Mar. 11, 1957, p. 133.**



CURRENT carries away metal particles (ions).

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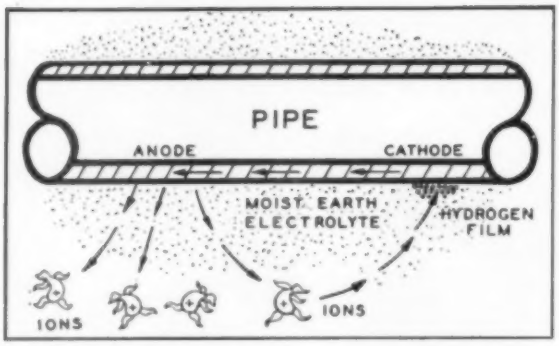
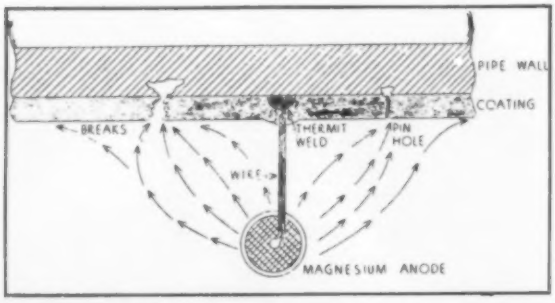
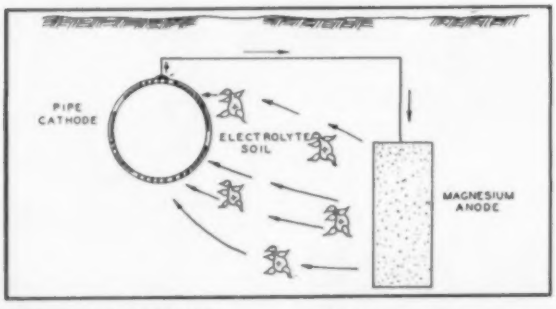
Refresher Quiz



GALVANIC CELL is set up with pipe as connecting wire, moist earth the electrolyte. Pipe corrodes at anode of cell.



MAGNESIUM ANODE AND COATING combination prevents corrosion at breaks and pinholes.



CATHODIC PROTECTION with sacrificial anode suppresses galvanic cells.

Q. How can stray current corrosion be mitigated?

A. By preventing current leakage at couplings. An electric path around couplings (bonding wire) keeps current in the pipe. **OGJ, Mar. 11, 1957, p. 133.**

Q. Corrosion engineers are generally agreed that the most economical corrosion-control program for a buried pipeline is a proper combination of coating and cathodic protection. When two coatings are comparable in total applied cost, what is an important basis for selection?

A. The coating with the lower current requirement is the material to use. **OGJ, Jan. 14, 1957, p. 133.**

Q. Three types of protective coatings were used on a recent project from Bridgeport to Fritch, Tex. What were they?

A. Natural Gas Pipeline Co. of America applied coal tar, its long-time criterion of pipe protection; asphalt; and polyethylene plastic tape. The program will test comparative performance of the materials. **OGJ, Dec. 9, 1957, p. 98.**

Q. What is the application technique of a fast catalytic-setting plastic (epoxy coal tar) coating applied in a yard recently by a major gas-transmission company?

A. A diesel-oil heater applies flames directly to the pipe to heat it to 170° to 190° F. (to shorten setting time); the pipe is cleaned of dirt, rust, and scale for tight bonding by a shot-blast machine; coating is sprayed on and dries in 12 to 15 minutes for handling. **OGJ, Dec. 16, 1957, p. 70.**

Q. What are the advantages of using lightweight pipe with a thin-film coating for gathering lines?

A. Studies show that for lightweight coated 4-in. in the Mid-Continent there will be an investment saving of 11.5 per cent or more than $1,000 a mile over standard pipe. Indicated maintenance savings are at least $18 per mile per year and a maximum of $65 per mile per year. **OGJ, Sept. 16, 1957, p. 130.**

Q. What are the shortcomings and their possible solutions to modern thin-film plastic coatings for pipe protection?

A. Relatively high cost, need for carefully controlled application conditions. The answer could lie in large-volume mill application. **OGJ, Sept. 16, 1957, p. 130.**

Q. How may maintenance records be kept to provide an up-to-date picture of past repairs, protective measures, and pipe condition?

A. Houston Pipe Line Co. has a visual record using a scale model of the entire pipeline. On it are plotted the location of repairs and replacements, the type of work done and the date, the general condition of the pipe from inspections made when leaks were repaired or the line was uncovered for any reason. **OGJ, Mar. 11, 1957, p. 170.**

Q. What is the advantage of such a visual record?

A. The corrosion engineer can see the start and growth of hot spots, pinpoint short sections of line where excessive repairs have been made, count the different types of leaks and the type of repair at any location, see the location of cathodic-protection installations, the time they were installed, and their value from a visual picture of the reduction of leaks. He can see a complete history of pipe-to-soil potentials plotted on the model. **OGJ, Mar. 11, 1957, p. 170.**

Beating Winter To The Punch

Many more Canadian homes and industries were served by natural gas last winter—due to the completion, early in December, of a new big-inch pipeline in southwestern Ontario.

The project, which adds 141 miles of 26-inch pipeline to the system owned by Union Gas Company of Canada Limited, was constructed in the short period of 45 working days in the late fall and early winter.

Canadian Bechtel Limited was the constructor. Although pipeline construction is a relatively new activity in the Dominion, project personnel were almost entirely Canadian.

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Maintenance

Colorado Interstate believes in do it yourself

. . . and is one of the few natural-gas-transmission companies which operate their own central machine shops. The company believes that the history of the operations of its shop is proof of the wisdom of the decision to do the work itself instead of contracting it out. The author is foreman of the shop, and should know whereof he speaks.

By J. W. HAWKINS

MOST of the machining needs of Colorado Interstate Gas Co. are handled by the company's own machine shop, located 8 miles east of Pueblo, Colo. The location, on Highway 96 in the Devine compressor-station area, affords excellent air, rail, and highway facilities along with a climate of low humidity and moderate temperatures.

The machine shop has about 3,500 ft. of floor space. It has a 5-ton overhead crane, a 12-ft. reel-type main door and is well equipped with machine tools to handle most machine jobs.

The shop is operated with a foreman and six machinists who have been company trained. In addition to their machinist training, they are experienced in station operation, general overhaul, and field work. Their work is not confined to the machine shop. When the need arises for a machinist's services at another location, he is sent to the field. This shop staff is able to perform all the major machine work required by the company.

A study has been made of current and completed work projects; our interesting experiences are dealt with in this article.

Safety-Valve Maintenance

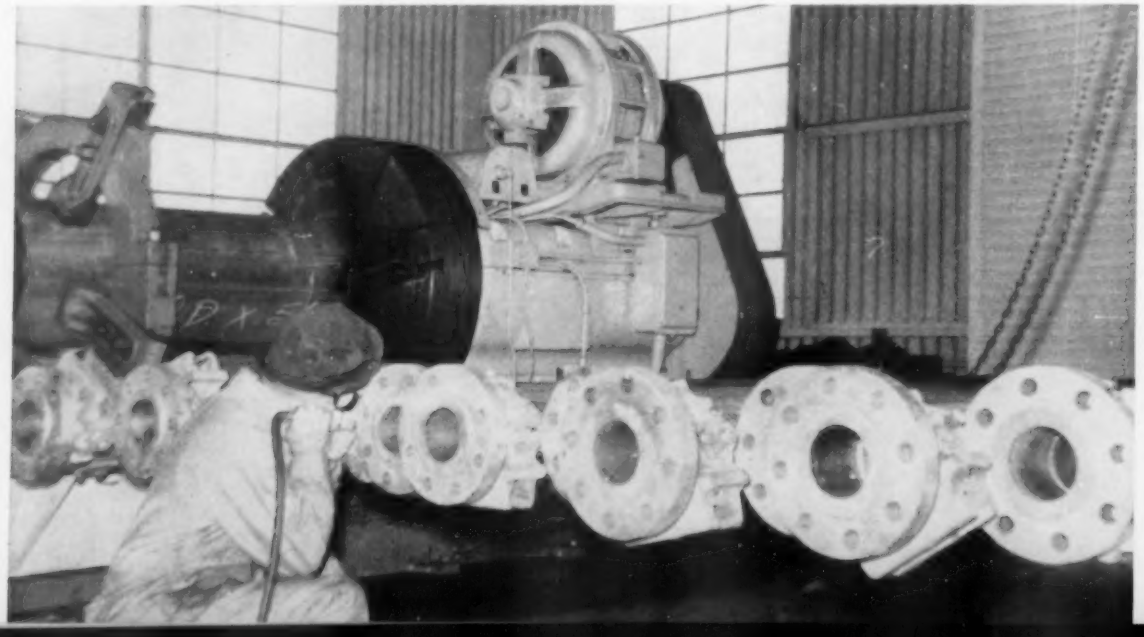
A planned safety-valve maintenance program is now under way with first emphasis being given to compressor stations. First we determined the manufacturer's type and size of valves at all locations. The various manufacturers were asked to recommend maintenance procedures. Seat lapping tools and other special tools necessary for proper maintenance were then purchased.

A test stand was the next consideration. There were several desirable features required of the test stand: It should be small enough to easily haul in a pickup truck; it should be capable of testing and setting valves ranging in sizes from ½ in. screwed to 6 in. flanged with pressures varying from 15 to 1,200 psi.; it should be independent of an outside test medium for emergency use, and it should be safe and fully portable.

As air and water are always available at the various locations, we decided to use air as the test medium and water as the compressor. In actual operation, the booster tank and the test tank are charged with about 250 psi. of air. Water is then pumped into the booster tank by means of a motor-driven hydrostatic pump and the air is compressed to the desired set pressure. One pressure gage is removed and a dead-weight tester connected to assure accurate settings.

To date, 180 various sizes and types of safety valves have been set and the test stand appears to be satisfactory. On maintaining the valves, the test equipment is sent into the field along with machine-shop personnel. The valves are removed from

GRINDING ORIFICE FITTINGS on meter-run assemblies is performed by T. D. Rote.



METALIZING FLYWHEEL on crankshaft is done for auxiliary engines. Machinists are D. E. Manley (left) and A. B. Chenoweth.

the line, disassembled, parts cleaned and inspected, and seats established by lapping and machining as required. The valves are then assembled and adjusted to the required set pressure. The blowdown rings are set in accordance with the manufacturer's recommendations.

On completion of the work, each valve is sealed and a record kept as to date, set pressure, work performed, and location. The poor working condition of many of the valves tested prior to disassembly has indicated a need for a regular maintenance schedule.

Safety-valve condition . . . The condition of the safety valves prior to maintenance work is described by these examples:

Seven valves that were required to relieve at 500 psi. were put on the test stand and the pressure raised to 700 psi. without popping the valves. Additional pressure was not applied.

One valve was in service with its adjusting screw tightened all the way, its spring almost totally compressed.

Two valves were found to be effectively gagged in an effort to stop their leaks and would not pop at any pressure.

Ninety per cent of the valves had damaged seats and were leaking. An example: One valve when tested, prior to disassembly, was found to leak evenly at 400 psi. with the hydrostatic pump discharge. The pump will discharge 265 cu. in. per minute against 1,000 psi. discharge pressure. The maximum working pressure of this valve is 425 psi.

Twelve valves were found to have set pressures that were out of range with their springs and new spring assemblies were installed.

Spindles, in some cases, were worn as much as 50 per cent of the cross-sectional area and were replaced.

Maintenance

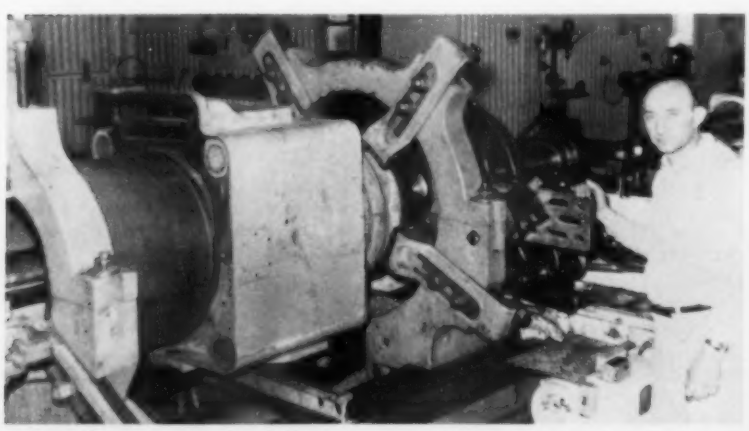
In the majority of cases, it is apparent that the accumulations of sludge and dirt under the valve's seat caused their leaky condition and damaged seats. It is also apparent that these valves will deserve our attention. The maintenance program is approximately 75 per cent complete. At the time of the next scheduled maintenance, it is planned to hydrostatically test the valves and to conduct magnetic-particle inspection of the valve body and its parts.

Metalizing

The metalizing process is extensively used in the machine shop. It is particularly adapted to packing surfaces subject to continuous wear. Colorado Interstate has eleven 1,000-hp. Worthington horizontal engines having a total of 44 power piston rods. Prior to metalizing these rods, packing and rod wear was a constant problem.

All of the rods were metalized with Spray Steel No. 80 and finish-ground to ± 0.001-in. tolerance. At the same time, the rods were straightened to with 0.005-in. of true. An average wear of 0.0005-in. per year was obtained as checked from a rod put into service in 1949. The same process is used on compressor piston rods with equal results as to wear.

In Colorado Interstate's gasoline plants, all of the LPG pump pistons have been metalized. The metalizing technique on the LPG piston varies from the standard practice due to the high volatility of the product. In this case, the piston is undercut to allow a minimum coat thickness of ⅛ in. The surface is then prepared by threading, given a light coat of Spraybond and built up with Spray Steel No. 80 in the usual manner.



SEVENTEEN-INCH cylinder is bored for installation of liner by John D. Ottino.

SCAVENGING PORTS in cylinder are ground out by John D. Ottino.

D. E. Manley and A. B. Chenoweth stand behind safety-valve test stand.

Care is taken to hold the buildup to a minimum for finishing.

While the surface is still warm, (but not over 125° F.), it is painted with a sealing mixture of 5 per cent cobalt drier and 95 per cent raw linseed oil. This painting is continued at regular intervals until the surface is both saturated and cool. The piston is then allowed to dry overnight before finishing, and is given additional 2 days' curing before being put into service. If the metalized surface is not sealed, the product will leak through the pores of the metalized surface and could cause a failure.

Three years ago, one of CIG's newer stations was having trouble controlling the wear on the bronze packing sleeves for the jacket-water pumps. After a few months' wear, the sleeves would be deeply cut by the packing and the sleeves would be replaced. We decided to metalize the sleeves with hard stainless steel (Metcallay No. 2) and observe the results.

The bronze sleeves were undercut and prepared by grooving and dovetailing. Metcallay No. 2 was then sprayed on the surface and the buildup was finish-ground to size. A year later micrometer measurements showed less than 0.001 in. wear. All available sleeves have since been metalized with equally good results. From a maintenance standpoint, it is better to metalize the new sleeves before putting them into service.

Metalizing is used successfully in restoring fits. Early this year, one of CIG's compressor stations was overhauling its auxiliary engines. On one of the engines, the flywheel was found to be loose on the crankshaft. Investigation revealed that it had been loose for some time with the resultant beating out of both the flywheel and crankshaft fits. The crankshaft, flywheel, and generator were brought to the machine shop for repairs. As the flywheel was 54 in. in diameter, it was necessary to use a 3-in. portable boring bar for the machine work.

In the boring operation, the flywheel was bored and the generator coupling fit was bored and faced. The crankshaft flywheel fit was then metalized and machined to suit the flywheel. It was also necessary to metalize and machine the coupling fit on the generator.

During the 1956 overhaul, we had trouble with the 26-in.-diameter scavenging pistons on the Clark BA engines. The ring lands on the bottom of the pistons had cold worked and closed the ring grooves over the rings, preventing the rings from working. The pistons were metalized with aluminum bronze (Spraybronze AA). On finish-machining the pistons, a relief was cut adjacent to each ring groove edge to prevent future closing of the groove. A total of 67 pistons were metalized in 3 weeks.

Boring and Installing Cylinder Liners

The machine shop has bored and lined 89 cylinders, power and compressor. On arrival in the shop, the cylinder is Magna-Flux inspected for cracks. The water jackets are then inspected and cleaned if required. A template of the cylinder ports is lifted and center lines established for cutting out ports after the liner is installed. The cylinder is set up and bored to receive a ¼-in. sidewall liner.

The liners are company stock items and are rough-machined on arrival from the foundry. When rough-machining the liners, 1/16-in. to 3/32-in. undersize is allowed in the bore for finish machining after the liner is installed. The liner is now set up and the o.d. finished to give an interference fit of approximately 0.0005 in. per inch of cylinder diameter. The liner is now ready to be installed in the cylinder.

The cylinder is gradually heated to bring its temperature up to round 250° F. When the cylinder approaches the correct temperature, the liner is packed in dry ice with alcohol being used to prevent frost. After the liner has been cooled for a half hour the fits are checked for clearance. With the clearance satisfactory, the liner is quickly unwrapped and installed in the cylinder. It requires about 20 seconds to install the liner and it is estimated that the allowable time would be about 65 seconds.

If the liner being installed is large, employes are called from nearby machines to lend a hand. Gloves are necessary when handling the cold liner to prevent burning the hands from the extreme cold. The cylinder is then finish-bored and the ports drilled out and ground to their original dimensions. The oil holes and indicator hole are drilled and the liner is ready for service.

Shop Fabrication

Colorado Interstate does much of its own fabrication for new construction and replacements, an example being the fabrication of meter runs. Since September 1954, 482 meter runs have been fabricated for new installations and replacements. In the fabrication of meter runs, the pipe is first measured to assure that it is within the tolerance as shown in the "Gas Measurement, Committee Report No. 2."

The pipe is then cut to length and the orifice fitting is welded in place. An expanding internal lineup clamp is used in the welding operation. The assembly is set up in a lathe, the pipe being supported by a steady rest on one end by a special fixture on the carriage at the other end. A follower-type boring bar is then floated through the orifice fitting to bore out the stringer bead.

With most of the stringer bead bored out, the meter run is moved from the lathe to the floor where it is completed by hand grinding and wire brushing. At this time, the meter run is calibrated and assigned a serial number with copies retained for future reference.

Another item of shop fabrication is the transition fitting. The desired weight and grade of pipe is selected and sent to the machine shop. The pipe is set up in a lathe and cut into 12-in. lengths. Each fitting is beveled for welding and taper-bored to the required weight. To avoid confusion in the field, each fitting is stenciled identifying it as to its size, grade, and weight.

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Effect of uphill flow on pressure drop in design of

Two-phase gathering systems

"... it is almost certain that at some later date the correlations presented here will be shown to be crude approximations. Until then ... the methods here described represent a sound approach for a design procedure."

BY ORIN FLANIGAN

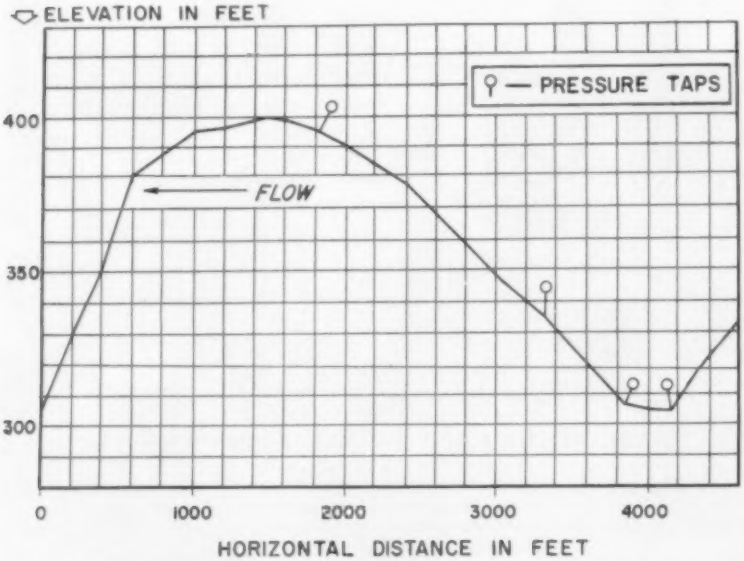
ARKANSAS LOUISIANA Gas Co. has designed and operated two-phase gas-condensate gathering systems for many years.

The basis for design of these pipelines was a relationship between line efficiency and the liquid-to-gas ratio. For the most part these lines were small in diameter, relatively short in length, and were laid in fairly level country. The design methods used were of sufficient accuracy so that no operating difficulties were encountered.

In 1954 a 16-in. pipeline was completed which was designed to carry gas and condensate from Hallsville field 25 miles to the Waskom gasoline plant in East Texas. This line was laid through rolling country, and was designed to transport 70 M.M.c.f. of gas and 70,000 gal. of condensate per day with a pressure drop of 80 psi. using the same method which had been used previously.

This line was placed in operation with a gas flow of 30 M.M.c.f. per day satisfactorily; however, the pressure drop soon built up to about 300 psi. instead of the 30 psi. predicted. In an effort to reduce this, the line was shut down and "pigged," bringing out about 200,000 gal. of liquid. The line was placed in operation again and the pressure drop was about 15 psi. Within 8 days, however, this had increased to 300 psi. again.

Since the operation of the line was so radically different from the design, checks on the design of the line were made. Ovid Baker, of Magnolia Petroleum Co., and Dr. R. L. Huntington, of University of Oklahoma, were supplied with the operating conditions. These men, on the basis of their previous experimental work on horizontal flow, concurred in the opinion that the pressure drop should be about 30 psi. The agreement of this information with the original design made it appear that detailed experimental measurement on the pipeline would be necessary.



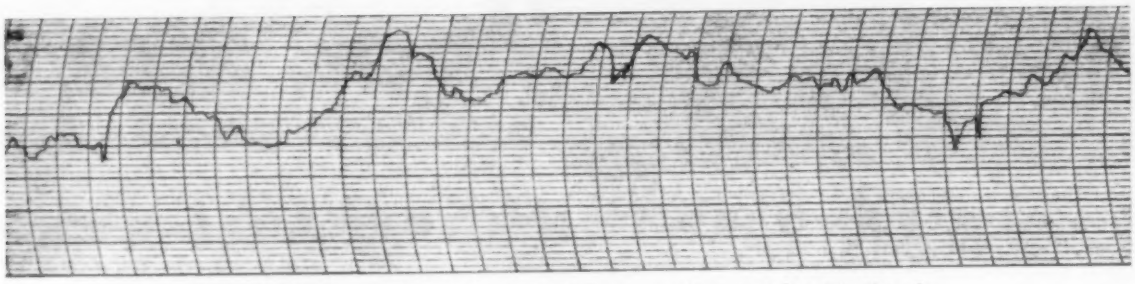
TEST SECTION represents slopes encountered on line. Fig. 1.

Experimental Work

A profile was obtained of the pipeline and several test sections were selected. One of these test sections is shown in profile in Fig. 1, with the location of the pressure taps indicated. These test sections were chosen throughout the length of the line and were selected to represent the various slopes encountered.

A series of five tests was set up, with the liquid and gas flow rates chosen to give as wide a range as was practical. Pressure readings on each section were made simultaneously. In some cases the pressure drops in a section were small so that extreme care had to be used in the measurements. In addition to the pressure measurements made with deadweight testers, strain-gage transducers were attached to the pressure taps and high-speed pressure-time recordings were made.

An example of one of these recordings is shown in Fig. 2. The recording tape speed in this instance was 5 mm. per second and the needle deflection was 10 mm. per pound. These recordings provided information as to the type of flow which was occurring at each point. Stabilization of the line was a major problem during



PRESSURE-TIME recordings show type of flow occurring at each point. Fig. 2.

these tests, and in some cases the line required 10 days to stabilize.

At the conclusion of these tests the data were assembled and examined. This examination made two facts stand out:

1. Practically all of the pressure drop in the tests occurred in the uphill section of the line.

2. The pressure drop in the line decreased as the gas flow rate increased.

Based upon these two general observations, a hypothesis was proposed and data developed to confirm it.

Hypothesis

When two-phase flow occurs in horizontal lines, the pressure drop is observed to increase as the gas flow rate increases. This effect has been observed by Huntington and White,[7] Armand,[1] Baker,[2] Chenoweth and Martin,[4] and others. When two-phase flow occurs in vertical lines, however, the pressure drop is observed to decrease as the gas flow rate increases.

This effect has been observed by Galegar, Stovall, and Huntington;[5] Poettman and Carpenter;[6] Calvert,[3] and others. While these two effects appear to be in direct conflict, their apparent differences can be resolved if it is assumed that there are two components of pressure drop in two-phase flow.

These two components may be represented graphically as in Fig. 3. One component is the pressure drop due to friction and is the only component existing in horizontal lines. The second component is the elevation effect due to the head of liquid in inclined lines, and is the principal component in vertical tubes at low gas velocities. The sum of these two components is the total pressure drop.

In Calvert's experiments, the gas flow rate in vertical tubes was increased to the point where the reversal of the total pressure drop shown in Fig. 3 was observed. The problem, then, is to separate the two components and to present a method of estimating each of them.

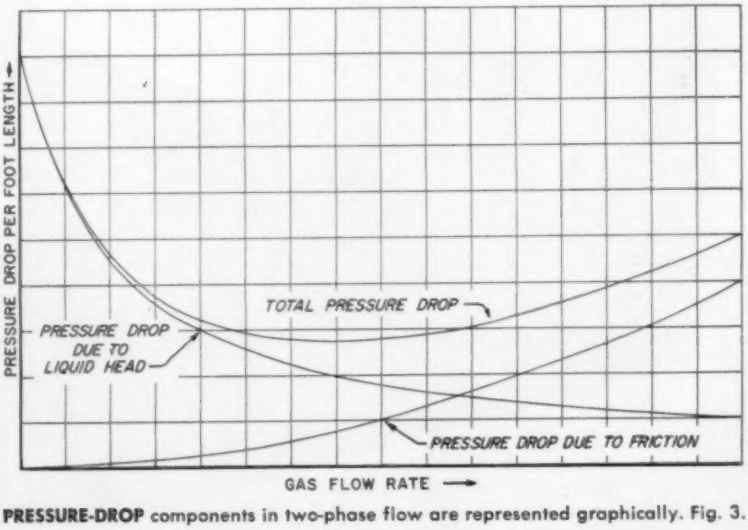
The Friction Pressure-Drop Component

Several methods have been presented for the estimation of pressure drop in horizontal two-phase-flow lines. Practically all of these methods are characterized by very lengthy calculations or lack of accuracy or both. When designing a gathering system it is usually necessary to try several different designs in order to find the most desirable one. Calculations of great length often make this practice prohibitive or discouraging. It is desirable, then, to have a simplified method for estimating pressure drop with a fairly high degree of accuracy.

Ovid Baker[2] has presented a simplified correlation of the line efficiency for horizontal two-phase flow as a function of the liquid-to-gas ratio. This is shown in Fig. 4. This is similar to the old method which was used by Arkansas Louisiana Gas Co. While this method is quite simple, the scattering of the data is so great that the accuracy is poor.

After examining Baker's original data, it was felt that a better simplified correlation could be obtained. The original data were reworked, and the resulting correlation is shown in Fig. 5. Here the efficiency is shown to be a function of gas velocity as well as the liquid-to-gas ratio. While there is still some scattering of the data, it appears to be well within the limits of experimental error giving a maximum deviation of plus and minus 9 per cent pipeline efficiency.

The data for this correlation were obtained in pipelines of 4, 6, 8, and 10-in. diameter. The gas velocities ranged from 1 to 12 ft. per second, and the liquid-to-gas ratio ranged from 20 to 1,200 bbl. per million. Thus the


PRESSURE DROP PER FOOT LENGTH
TOTAL PRESSURE DROP
PRESSURE DROP DUE TO LIQUID HEAD
PRESSURE DROP DUE TO FRICTION
GAS FLOW RATE

PRESSURE-DROP components in two-phase flow are represented graphically. Fig. 3.

THE AUTHOR

Orin Flanigon, chemical engineer, Arkansas Louisiana Gas Co., Shreveport, was graduated from Louisiana Polytechnic Institute in 1949 with a B.S. in chemical engineering. In 1949-51 he received M.S. degrees in gas technology and chemical engineering from the Illinois Institute of Technology. He was distribution engineer with Laclede Gas Co., St. Louis, from 1951-53, and joined Arkansas Louisiana in 1954.

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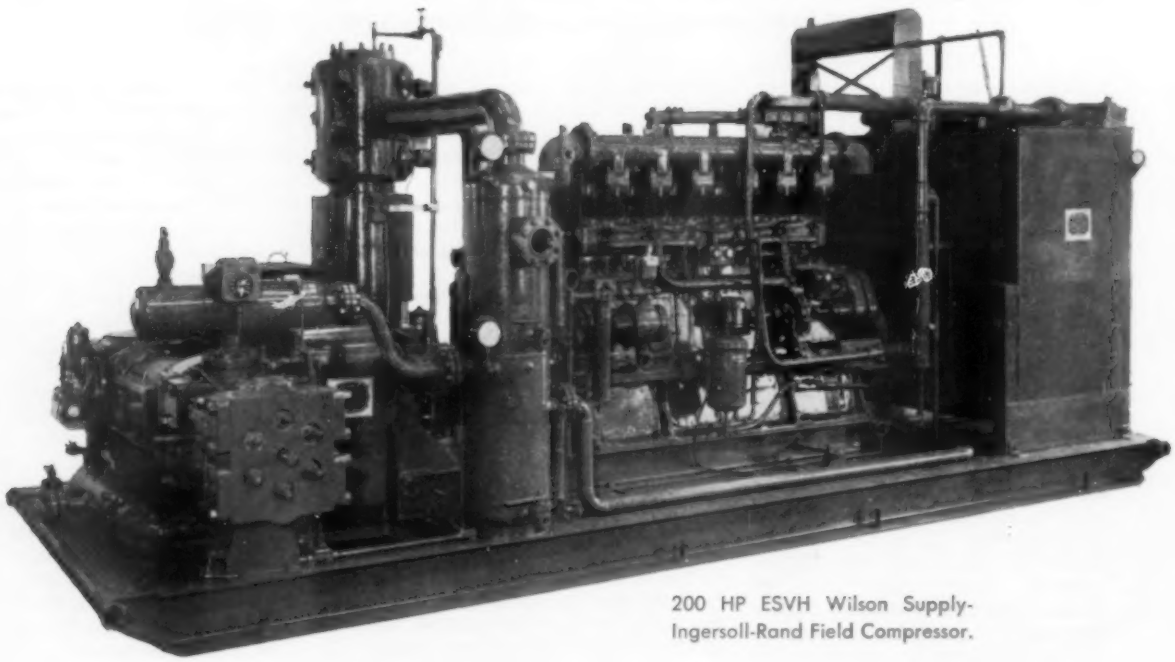

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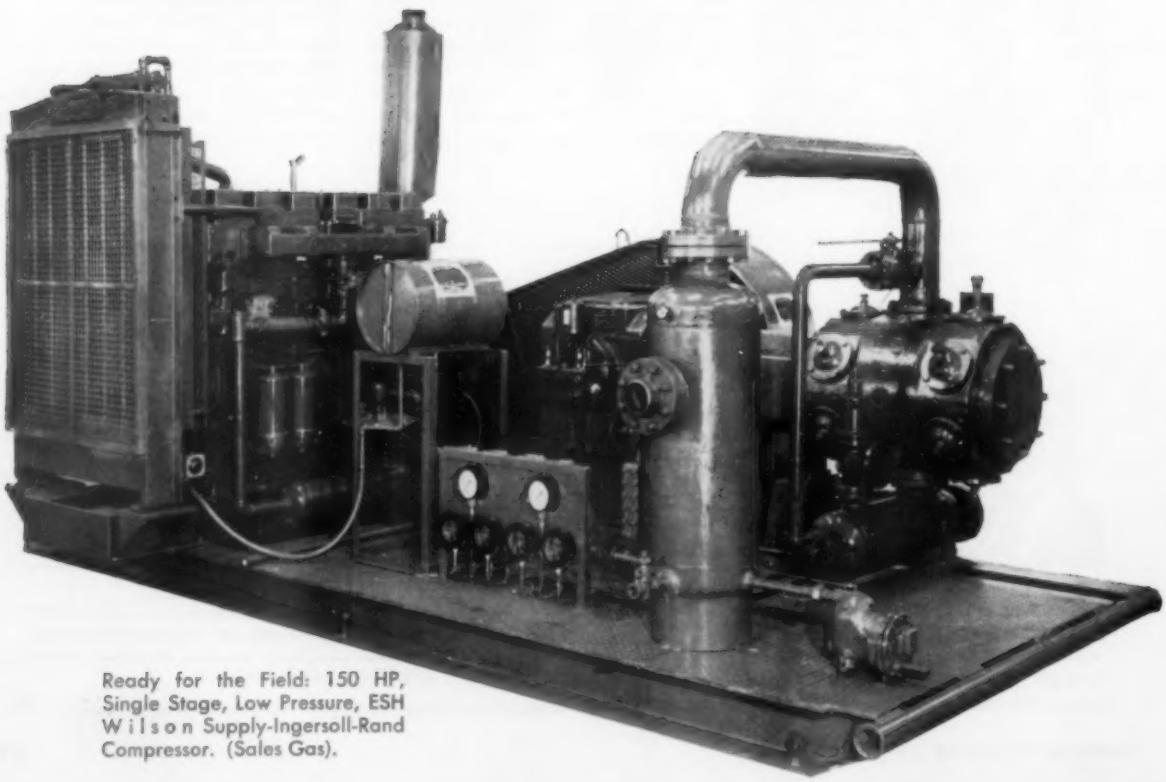

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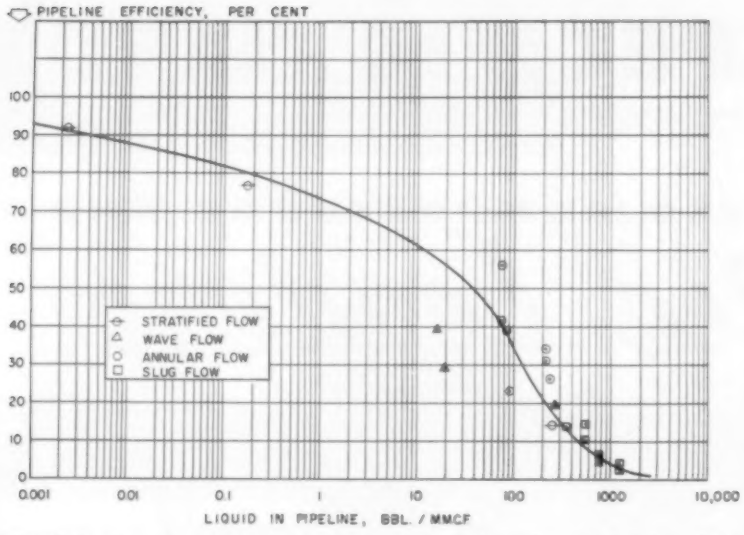


CORRELATION of line efficiency for horizontal two-phase flow as function of liquid-to-gas ratio. Fig. 4.

Suggested design procedure . . .

In order to use the information presented here for the design of two-phase gathering systems, the following design procedure is recommended:

1. Estimate the daily gas volumes, liquid volumes, and field pressure available.
2. Calculate the superficial gas velocity by the formula:

$$u = 31{,}194 \frac{QZ}{D^2P}$$

u = gas velocity, feet per second
Q = gas flow rate, M.M.c.f.d.
Z = supercompressibility factor
D = inside diameter of pipe, in.
P = average pressure in the pipeline section, psia.

3. Calculate the liquid to gas ratio "R" in barrels per M.M.c.f. of gas.
4. Calculate $u/R^{0.32}$ and determine the line efficiency from Fig. 5. This line efficiency may be used directly with the Grizzle slide rule.
5. Using the pipeline efficiency obtained in step 4, calculate the pressure drop due to friction.
6. From the gas velocity, obtain the elevation factor E_H from Fig. 6.
7. From a profile of the line, obtain the summation of the rises, ΣH. If a profile is not available, elevation of all high and low points may be used. Quadrangle maps, when available, may be used. If no maps are available, ΣH must be estimated. Typical values are 80 ft. per mile in the East Texas area and 120 ft. per mile in the Ruston, La., area.
8. Calculate the pressure drop due to elevation by the formula:

$$\Delta P = \frac{\rho_L E_H \Sigma H}{144}$$

9. Calculate the total pressure drop by adding the friction component and the elevation component.

In order to test the validity of this design procedure, it was desirable to compare the actual with some calculated pressure drops. In making the five tests on the test sections in the 16-in. line mentioned earlier, pressure-drop measurements were obtained on some fairly long sections of line which were not used as test sections. Table 1 shows a comparison of the actual and the calculated pressure drops in these sections. It can be seen that the agreement is good.

correlation should be applicable to a fairly wide range.

Elevation Pressure-Drop Component

Some information is available in the literature concerning two-phase flow in vertical tubes. Practically no information is available, however, which can be directly applied to the uphill sections of pipelines. In order to gain information on the characteristics of two-phase flow in the uphill sections of pipelines, the test data from the 16-in. line were again examined. These data permitted some further qualitative observations. These are:

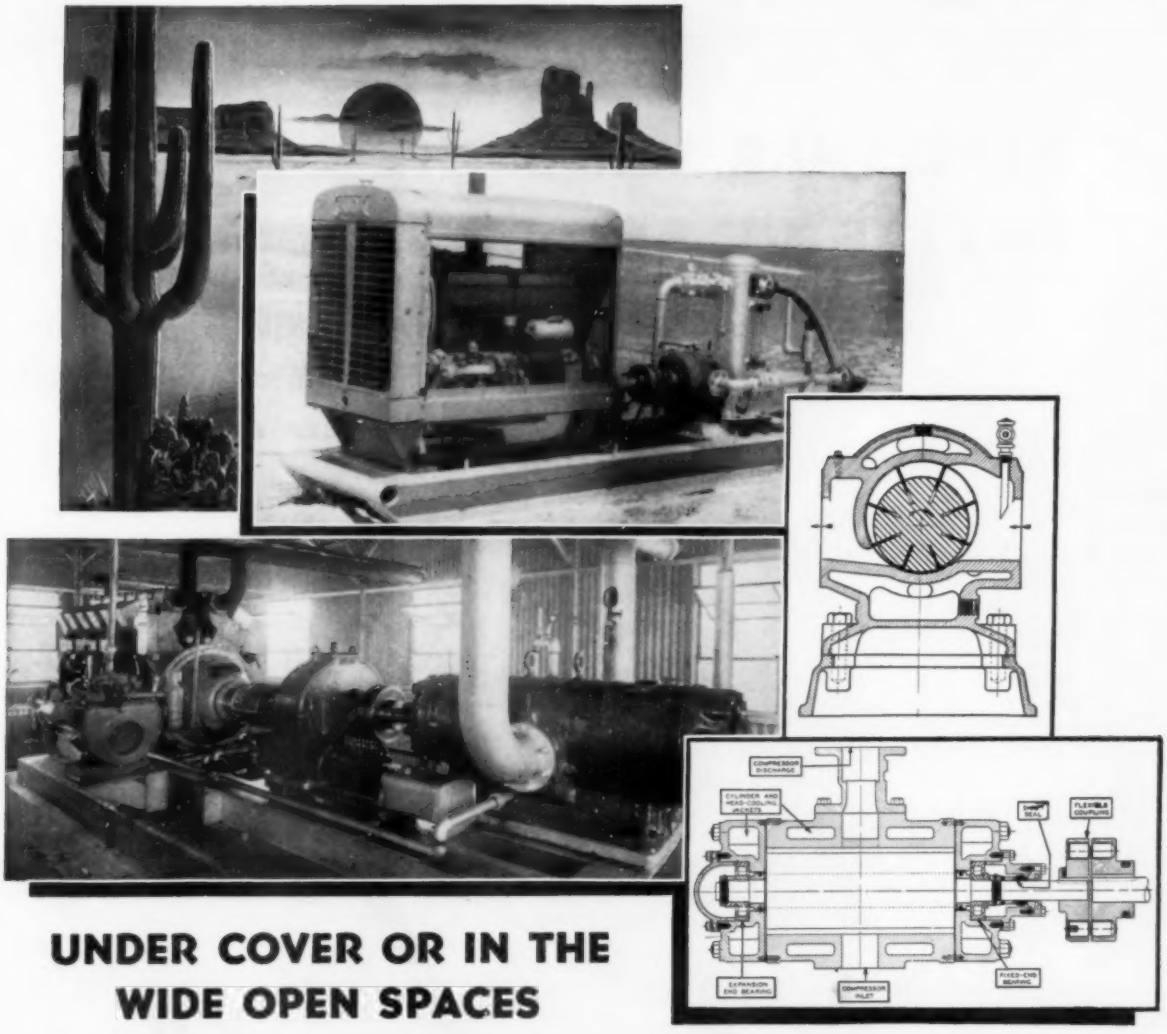
1. At the relatively low gas velocities used in the tests, the large portion of the total pressure drop in the line occurred in the uphill sections.
2. The pressure drop is directly proportional to the sum of the uphill rises in the pipeline. The elevation difference between the terminals of the line is of no consequence. The summation of the uphill rises determines the pressure drop. This summation can be called ΣH.
3. The slope of the hill is of no importance other than the way in which it affects ΣH.
4. The pressure drop varies inversely with the gas velocity.

From these observations it was found that for purposes of determining the effect of elevation, the summation of the uphill rises could be represented by a vertical column whose height is equal to ΣH.

If this column were filled with the flowing liquid, a static pressure drop would exist between the bottom and top of the column corresponding to the height of the column and the density of the liquid. Since a two-phase line is not completely filled with liquid, only a portion of this static pressure drop is experienced in actual practice. The term E_H may be used to represent that fraction of the total static pressure drop which exists as the elevation component in two-phase flow.

Using this approach, a correlation was developed between E_H and the gas velocity with the data from the 16-in. line. Since these data represented only one diameter and rather low gas velocities, however, it was desirable to obtain a wider range of data. Because of the discussion above comparing the total uphill rises in a pipeline to a single vertical column, it appeared that the experimental data on two-phase flow in vertical tubes could be used.

A search of the literature showed that Seymour Calvert had reported some data for the flow of air and water in vertical 1-in. tubes. Dr. Huntington, et al., also did experimental



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D9 WITH KELLY RIPPER (left) prerips unexpected rocky soil for ditcher. The Cleveland Ditcher (right) which follows is powered by a dependable Cat D339 Engine. The ditcher is cutting a depth of 65 inches at about 28 feet per minute.

NATURE put R. H. Fulton & Co. to the test during a 241-mile natural gas pipeline job across the Mojave Desert from Needles to Newhall, Calif.

Rock cropped up unexpectedly. Unseasonable high winds held up welding and painting, at times backfilled the ditch. Sand made maintenance of a firm ditch difficult. There were three river crossings and rugged mountainous terrain. But Fulton, with the help of its big Caterpillar spreads, overcame each obstacle, lowering in an average of 5,000 to 6,000 feet a day with a one-day high of 16,000 feet.

The 30-inch line is part of a $33.5 million joint expansion program of Southern California and Southern Counties Gas Companies. It will provide an additional 227.6 million cubic feet of gas per day.

Here are some of the problems Fulton encountered and how they were overcome:

ROCK—This occurred in stretches of presumably sandy material from 9 to 24 inches below the surface. By using huge Kelly Rippers mounted on the giants of the spread—CAT* D9 Tractors—a great deal of shooting was eliminated. The D9-Kelly Ripper combination prerripped the rocky soil for the ditcher.

Because of danger of rock damage to pipe in backfilling, the entire length is padded on the bottom of the ditch and top of the pipe. Two Cat No. 977 Traxcavators* and a Crosse Ditch Padder side-mounted on a D8 were used for the padding operation. A D7, working with a No. 12 Motor Grader, backfilled.

WIND—Unseasonable high winds backfilled the ditch and periodically stopped welding and painting operation. But welding crews set a brisk pace in spite of the winds. Using Caterpillar* Twin Arc-Welders on Athey track wagons pulled by a D7, their best day was 16,200 feet.

MOUNTAINOUS TERRAIN—Rugged Kane Springs Canyon and the Ord Mountains had to be crossed. A D8 and D9 were used to winch a Northwest Backhoe over the steep canyon grade. Later, D9s towed stringing trucks in and out of the mountainous area.

Altogether, Fulton had almost 70 Caterpillar track-type Tractors and Pipelayers at work. In addition there were five Twin Arc-Welders, and dependable Caterpillar Diesel Engines powered cranes, backhoes and ditchers.

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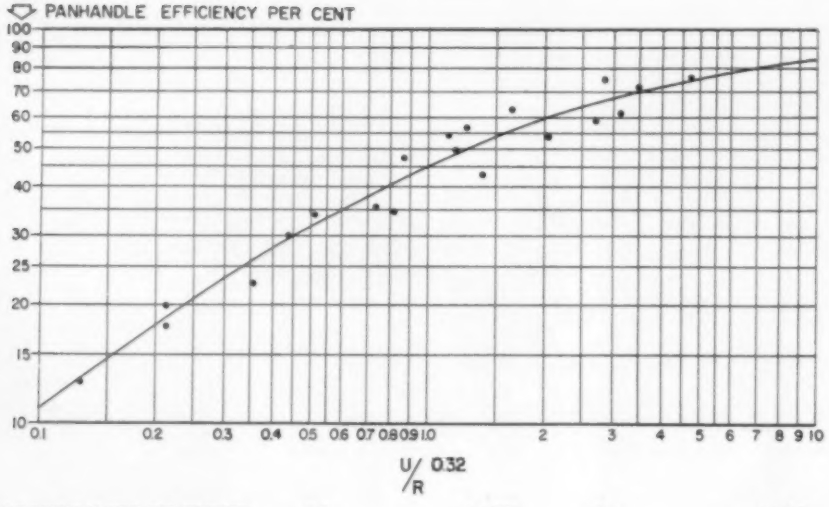


CORRELATION for friction component of pressure drop with natural gas and condensate. Fig. 5.

COORDINATES OF CURVE

$U/R^{0.32}$	Efficiency
0.1	0.1084
0.15	0.1457
0.2	0.1777
0.4	0.2767
0.6	0.3487
1.0	0.4492
1.5	0.5330
2.0	0.5917
4.0	0.7199
6.0	0.7819
8.0	0.8197
10.0	0.8460

EXPERIMENTAL DATA POINTS

$U/R^{0.32}$	Efficiency
4.76	74.6
2.03	53.2
0.85	47.1
0.72	35.2
0.36	22.7
0.21	17.6
2.85	75.3
1.24	57.0
0.50	33.8
0.43	29.5
0.21	19.7
0.124	12.8
2.71	58.7
3.40	70.7
1.16	49.2
1.62	63.6
3.11	60.0
1.37	42.5
1.11	54.0
0.81	34.7

TABLE 1

Gas flow rate M.M.c.f.d	Liquid flow rate gas per day	L miles	ΔH feet	ΣH feet	Calculated ΔP psi.	Actual ΔP psi.	Deviation	Per cent deviation
26.87	17,000	3.39	17	311	43.2	44.9	− 1.7	− 3.8
35.17	36,800	3.39	17	311	37.3	37.6	− 0.3	− 0.8
12.32	31,060	3.39	17	311	61.3	53.9	+ 7.4	+13.7
14.06	19,390	3.39	17	311	58.9	57.5	+ 1.4	+ 2.4
33.40	26,110	3.39	17	311	39.2	40.0	− 0.8	− 2.0
26.87	17,000	2.10	—89	204	27.7	26.4	+ 1.3	+ 4.9
35.17	36,800	2.10	—89	204	24.1	24.1	0.0	0.0
12.32	31,060	2.10	—89	204	39.9	40.8	− 0.9	− 2.2
14.06	19,390	2.10	—89	204	38.4	39.2	− 0.8	− 2.0
33.40	26,110	2.10	—89	204	25.5	29.0	− 3.5	−12.7
26.87	17,000	13.17	62	1,002	128.3	124.8	+ 3.5	+ 2.8
35.17	36,800	13.17	62	1,002	110.9	112.8	− 1.9	− 1.7
12.32	31,060	13.17	62	1,002	185.9	173.1	+12.8	+ 7.4
14.06	19,390	13.17	62	1,002	176.9	161.6	+15.3	+ 9.5
33.40	26,110	13.17	62	1,002	117.2	118.4	− 0.8	− 0.7
26.87	17,000	5.42	—20	371	40.1	40.8	− 0.7	− 1.7
35.17	36,800	5.42	—20	371	35.1	35.9	− 0.8	− 2.2
12.32	31,060	5.42	—20	371	61.6	62.5	− 0.9	− 1.4
14.06	19,390	5.42	—20	371	58.4	60.3	− 1.9	− 3.2
33.40	26,110	5.42	—20	371	37.9	35.3	+ 2.6	+ 7.4
26.87	17,000	25.19	1	2,003	244	252	− 8	− 3.2
35.17	36,800	25.19	1	2,003	212	224	−12	− 5.4
12.32	31,060	25.19	1	2,003	365	351	+14	+ 4.0
14.06	19,390	25.19	1	2,003	347	346	+ 1	+ 0.3
33.40	26,110	25.19	1	2,003	228	230	− 2	− 0.9

work with air and water in a vertical 2-in. tube and with air and SAE 10 lube oil in a sloping 2-in. tube. In addition, Poettman and Carpenter have reported data for the flow of oil, gas, and water in gas-lift oil wells. These data were corrected for the pressure drop due to friction as discussed earlier in this report, and the correlation of all the data appears in Fig. 6.

Conclusions

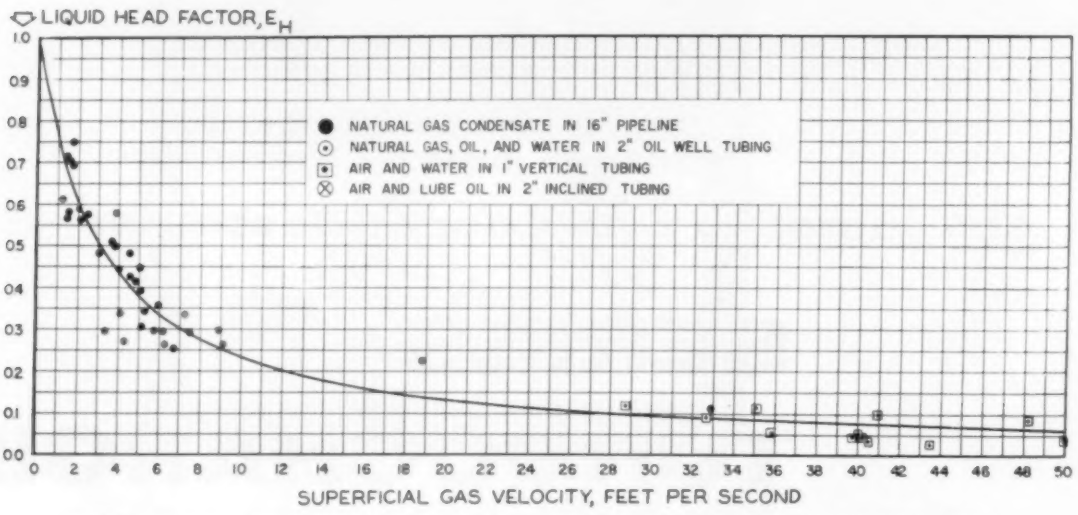
The correlation developed in Fig. 5 for the friction component of pressure drop was developed from data on natural gas and condensate. While it appears to be quite adequate for this type of system, it is doubtful that it would apply to other liquid phases. The viscosity of the liquid phase would probably influence the line efficiency considerably.

The correlation developed in Fig. 6 presents a method for estimating the pressure drop in the uphill sections of pipelines. This is the only known correlation for this purpose supported by a fairly large amount of experimental data. While there is considerable scattering of the data in Fig. 6, it must be remembered that the data presented represent a wide variety of fluids over a wide range of flow conditions.

It is inevitable that future developments will add to the knowledge of two-phase flow. It is almost certain that at some later date the correlations presented here will be shown to be crude approximations. Until such time, however, it is believed that the methods presented here represent a sound approach for a design procedure.

Acknowledgment

The author thanks Arkansas Louisiana Gas Co. for permission to publish this information and the many employes who assisted in the field tests. The author is also indebted to


LIQUID HEAD FACTOR, E_H
NATURAL GAS CONDENSATE IN 16" PIPELINE
NATURAL GAS, OIL, AND WATER IN 2" OIL WELL TUBING
AIR AND WATER IN 1" VERTICAL TUBING
AIR AND LUBE OIL IN 2" INCLINED TUBING
SUPERFICIAL GAS VELOCITY, FEET PER SECOND

METHOD for estimating pressure drop in uphill sections of line is indicated in this correlation. Fig. 6.

COORDINATES OF CURVE

U	E_H
0	1.0000
0.2	0.9387
0.4	0.8842
0.6	0.8361
0.8	0.7930
1.0	0.754
1.5	0.671
2.0	0.605
2.5	0.551
3.0	0.506
4	0.434
5	0.380
6	0.338
7	0.304
8	0.277
10	0.235
15	0.170
20	0.133
25	0.109
30	0.093
35	0.080
40	0.071
50	0.058

EXPERIMENTAL DATA POINTS

System—Natural Gas and Condensate

U	E_H
3.78	0.5096
3.81	0.5044
3.99	0.4450
5.18	0.3062
5.07	0.4496
5.10	0.3912
5.33	0.3409
6.74	0.2574
1.50	0.7177
1.51	0.5630
1.59	0.5824
2.23	0.5651
1.69	0.6988
1.70	0.7001
1.81	0.7467
2.52	0.5745
4.58	0.4825
4.60	0.4284
4.83	0.4127
5.95	0.3562

Oil, Water, and Gas

8.92	0.299
6.22	0.297
3.40	0.293
4.08	0.399
7.22	0.339
7.46	0.293
5.78	0.298
4.31	0.271
3.09	0.486
1.25	0.613
3.82	0.580
2.08	0.592
6.26	0.264
9.05	0.267

Air and Water

40.8	0.056
42.8	0.048
45.0	0.039
35.9	0.054
39.8	0.042
43.5	0.029
35.1	0.112
41.0	0.097
48.2	0.086
28.7	0.119
32.7	0.094

Air and Lube Oil

32.9	0.1112
18.8	0.2261

Nomenclature

- D = Inside pipe diameter, in.
- E = Panhandle flow efficiency
- E_H = Elevation factor—the fraction of the pressure drop which would exist if all uphill sections of a pipeline were filled with the flowing liquid
- ΣH = Summation of the uphill rises in the direction of flow, feet
- L = Line length, miles
- P = Pressure, psia.
- R = Liquid-to-gas ratio, barrels per million
- T = Temperature, °R.
- u = Superficial gas velocity, feet per second
- ρ_L = Density of liquid, pounds per cubic foot
- Z = Supercompressibility factor
- Q = Gas flow rate, M.M.c.f.d.

Edward N. Henderson, vice president and chief engineer of Arkansas Louisiana Gas Co., for his advice and encouragement throughout the project.

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"Roughly translated, it says they finally turned to hunting after running into nothing but dry holes!"

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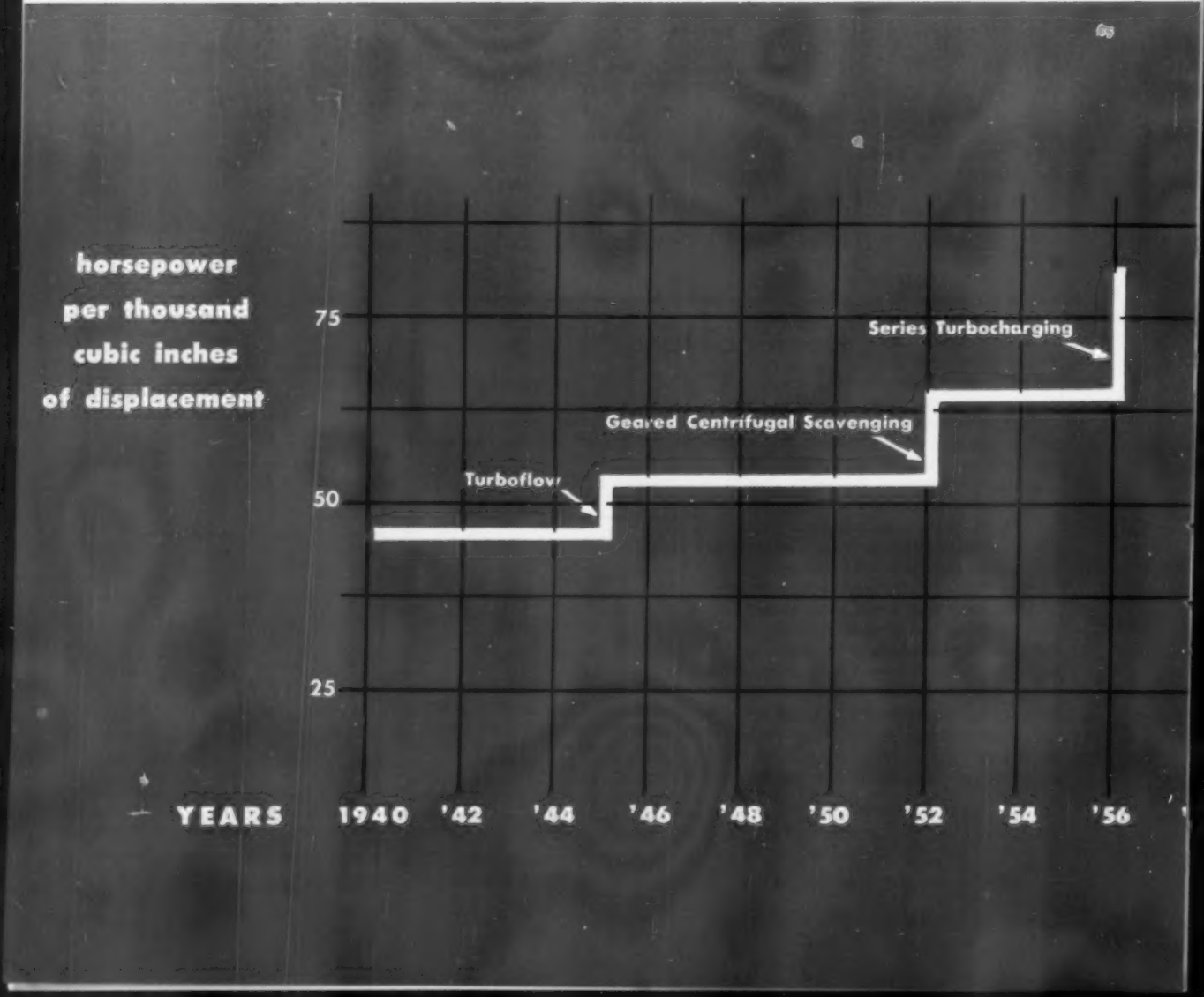
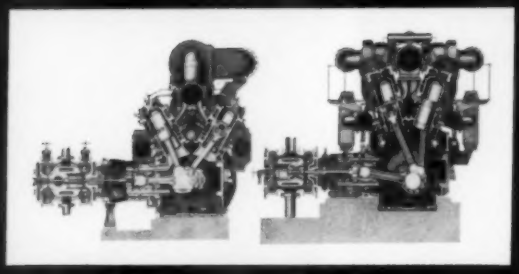


Cross section of Series Turbocharged GMVC V-Angle compressor 720 to 1800 bhp.

Cross section of Series Turbocharged GMWC V-Angle compressor 2000 to 3500 bhp.



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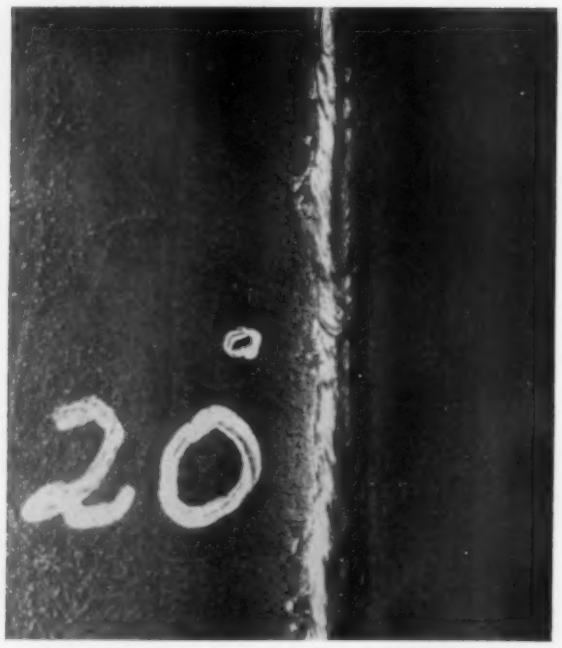
WIDTH OF 20° BEVEL is shown by steel measuring tape.



STRINGER BEAD on 20°-bevel is shown inside the pipe.

New joint design is needed in PIPELINE WELDING

Here's the first report of field tests with 20° bevel. Next step may be new combination bevel

BY LEONARD J. CUNNINGHAM

NORTHERN NATURAL Gas Co. has been extremely weld conscious and is continually endeavoring through experimental welding to upgrade quality, speed up production, and if possible lower welding costs. We have been experimenting with joint design. It was evident to us that employing presently accepted joint design, manual arc-welding peak production has been reached.

No experimenting has been reported for a change in joint design for pipeline welding in the last 25 years since the 30° bevel with ⅛-in. land had been established as satisfactory. The author is an ardent advocate for smaller and smaller welds on pipeline construction.

The trend at one time seemed toward the smaller weld with the exit of the large acetylene ripple welding and the advent of the Lindeweld method which reduced the weld size to a fraction of the former popular ripple weld.

Then came electric welding in pipeline construction which did not necessarily reduce the size of the weld from the Lindeweld process, but was much more satisfactory in that the heat zone was confined to a much smaller area.

This resulted in a reduction of stress accumulations and a more rapid return to atmospheric temperatures without a serious quenching or hardening effect to the weld metal or the heat zone adjacent to the weld.

With all the advantages of electric welding little has been done since its introduction to pipeline welding to realize to the fullest its possibilities, while welding in other phases of industry has made sensational advancement. Therefore it seemed appropriate to explore the possibility of economies which might come with the use of a narrower groove requiring the deposit of less weld metal.

After many test welds, it was determined that 20° bevel was most likely to conform with our expectations. On a recent construction project in the El Dorado, Tex., area, involving approximately 84.5 miles of 16-in. by 0.250-in. wall Grade X-52 line pipe, we welded approximately 35 miles using 20° (tolerance + 5° —0°) bevels on the pipe ends which definitely established that production can be stepped up after the stringer bead is made.

We found that although three

TAPE SHOWS WIDTH of finished 30°-bevel weld.

VIEW INSIDE PIPE shows stringer bead on 30°-bevel.

stringer-bead welders were required to keep production of the pipe gang at a level equal to that of the welders on 30° bevels, the hot-pass crew consisting of four welders on 30° bevel was eliminated entirely. Not a single stringer bead was broken or cracked in the 35 miles. This is attributed to the thickness of the stringer bead varying from 40 per cent to 60 per cent of the wall thickness of pipe due to the narrow groove of 40° included angle of the bevels. In effect, the equivalent of the stringer bead and hot pass was applied in one operation by three stringer-bead welders, whereas on 30° bevels, six welders were required to accomplish the same production.

This is the first project known to the author where three stringer-bead welders have worked together on pipe as small as 16-in. Three and four stringer-bead welders are fairly common for 30-in. diameter and larger.

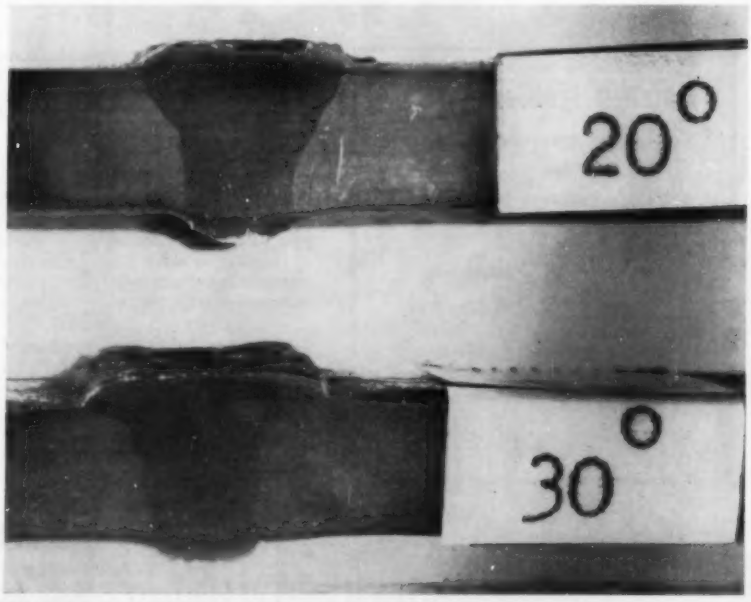
After the stringer bead was applied, it required the firing line or finish welders 15 per cent less time to complete a weld than on 30°-bevel weld. The electrode consumption was reduced 11.3 per cent. The time requirement for three welders to run the stringer bead was identical to that of two welders on 30° bevel. The finished weld on 20° bevel was approximately ⅛ in. narrower than that of 30° bevel weld.

Laboratory Tests Verify Quality

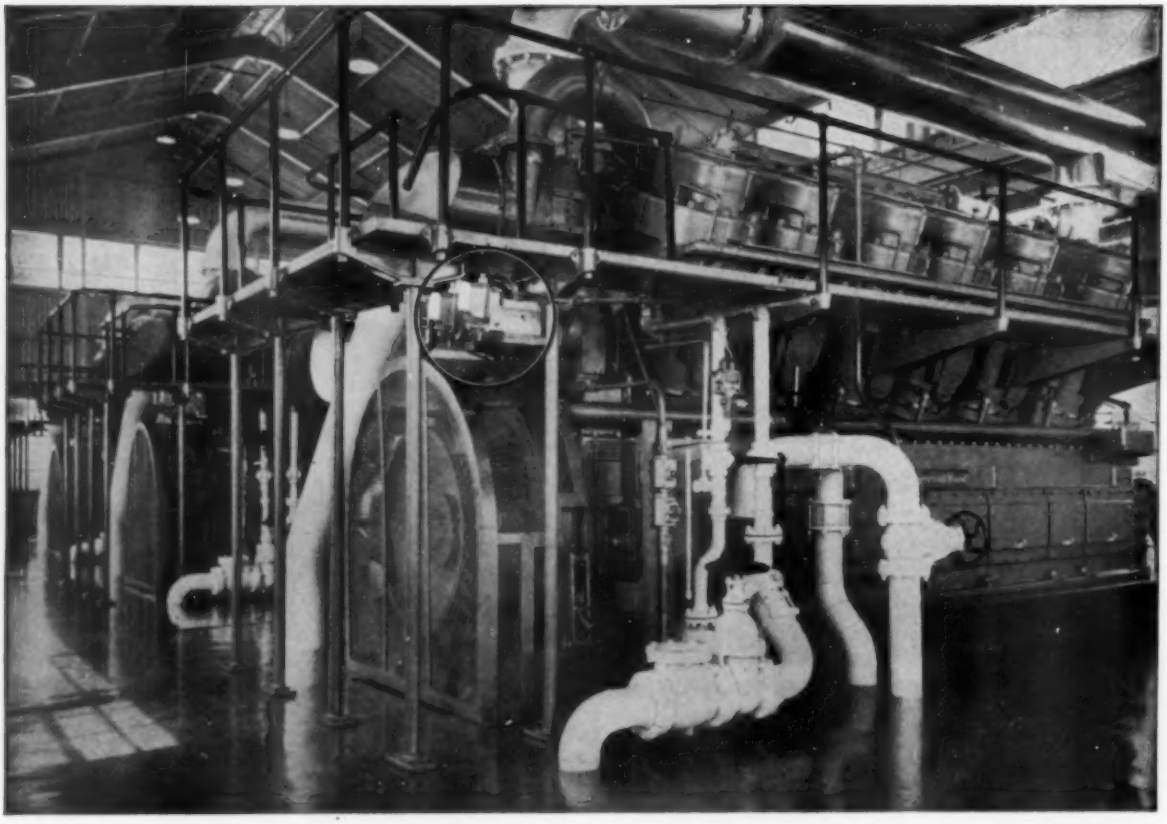
In order to further substantiate the quality of the 20°-bevel weld, we had one weld tested by an independent laboratory. This weld was selected at random and removed from the pipeline after the construction crew had moved out of the area. We feel that the information contained in their report which is quoted herein is a true representation of the quality of the welding throughout the entire project.

On January 18, tests of weld on 20° pipe were reported by Pittsburgh Testing Laboratory to Northern Natural Gas Co. as follows:

X-ray examination showed acceptable weld quality in four films: A—¼-in. (distance along weld) inadequate penetration; B—no defects; C—no defects; D—⅜-in. (distance along weld) inadequate penetration very slight undercutting on root pass. All



ETCHED CROSS-SECTION of 20° and 30°-bevel welds shows that upper half of 20° was wider than necessary. Welders unused to the narrower groove were cooperative but not enthusiastic toward the smaller weld.



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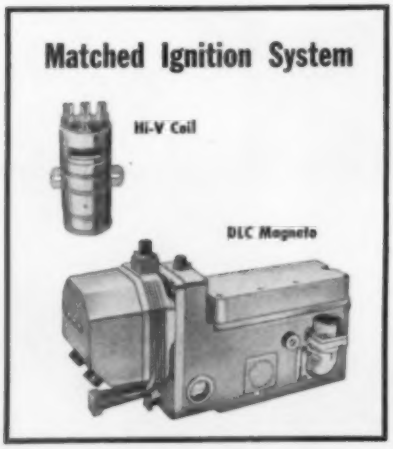

Trunkline Gas Company of Houston, Texas, operates a natural gas transmission line extending from near McAllen, Texas, to Tuscola in central Illinois where it connects with the line of the Panhandle Eastern Company.

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defects noted are within the accepted limits for pipeline welding.

Tensile tests were passed with diagonal fracture through the weld pipe. For Mark 1, 0.3704-sq. in. area, total load was 28,800 lb.; tensile strength, 77,750 psi. For Mark 2, 0.3740-sq. in. area, total load was 29,100 lb.; tensile strenth, 77,800 psi.

Face and root requirements were met in four tests. Nick and break requirements were met with no defects in two tests.

Rockwell hardness test was run on four different specimens starting in one pipe and through the weld into the other pipe. The number with "P" in front designates in pipe, and the ones with "W" in front designate in weld.

Rockwell B. Hardness

Mark	
1	P78, P80, W88, W84, W83, W84, P82, P80, P82
2	P77, P77, W81, W86, W88, P88, P83, P87
3	P77, P77, P82, W82, W84, W79, W73, P79, P78
4	P85, P83, P92, W89, W88, P82, P77

Four (4) specimens were buffed and etched in 1/1 nitric acid. All four (4) specimens showed good penetration and fusion with no porosity or any other defects noted.

It has been proved that through the use of proper electrodes the smallest possible weld maintaining soundness is best from the viewpoint of lower stress accumulations, high tensile strength, and ductility.

Lineup Problems of 20° Bevel

Some aspects of the 20° bevel caused concern. Pipe with this bevel was difficult to line up because it required greater accuracy in spacing. Visual observation sufficed on 30° bevels, whereas on 20° bevels, a 3/32-in. spacing tool was required. More high-low could be tolerated on 30° bevel lineup than on 20°. It was found that allowable high-low on 30° bevel could not be accepted on 20° bevel as it would result in undercutting on the inside.

Except for the extra time required in lineup because of the need for closer tolerances, there were no more difficulties in the welding with 20° bevel than there would have been with a 30° bevel.

Lining up was done with a mechanical type of internal clamp because this was the most satisfactory type available for 16-in. pipe. It is probable that with pneumatic lineup clamps the 20° bevel would have proved far less difficult and the end results would have been more favorable. The advantages of the extra power and speed of the pneumatic clamp are now so apparent that this type will be specified for pipe of 20-in. in diameter and larger for Northern Natural Gas Co. construction projects for this year.

With the pneumatic clamp, hammering on the pipe is minimized.

Even though there were some drawbacks to the 20° bevel, the test pointed up the possibilities for economy and production achievement in further studies of joint design. It was gratifying to discover that the narrower groove made it possible to produce a stringer bead of such strength that hot-pass welding could be eliminated on the Eldorado project.

The 35 miles of 20° bevel (tolerance +5—0) pipe was furnished with a 1/16-in. flat-faced land, according to our company's specification by Youngstown Sheet & Tube Co. The remainder of the pipe for this 84.5-mile, 16-in. project was finished with the usual 30° bevel with 1/16-in. land.

Welders were qualified in accordance with API 1104 Standard for field welding of pipelines. All electrodes were 85-P shield arc. Northern Natural follows a policy of using only one type for all beads in pipeline welding. For the first and second beads, the electrodes are 5/32 in., for the third bead 1/4 in.

What is likely to be the next step? Consideration is being given to a combination bevel. For this, the lower half of the pipe wall would be cut with a 30° bevel; the upper half would be cut with a 11° bevel. The land would be 1/16 in. Test welds may be made soon to determine whether this type of narrow-groove joint design would be satisfactory for reducing the amount of weld metal needed for pipeline welding.

THE AUTHOR

Leonard J. (Shorty) Cunningham, assistant pipeline superintendent, Northern Natural Gas Co., Omaha, grew up at Lipan, an inland town in Central Texas. He went from railroading into welding, first as a welder's helper with Chestnut & Smith Corp. In 1930, he became welding foreman for Northern Natural Gas Co. when the company started. In 1948, he was promoted to his present position.

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TWO 20-IN. PIPE SECTIONS 500 ft. long with 8-in. vent line on top make a new test. Thus . . .

Slug catcher at gas-separation plant

handles incoming slugs of liquid in offshore line

By LARRY RESEN
District Editor

A "SLUG CATCHER" is an integral part of the facilities at United Gas Pipe Line Co.'s Burns gas-separation plant (Fig. 1).

The bottom of the Gulf of Mexico is very flat and the pipeline approaches the shore line on a slight uphill gradient. As a result liquids in the pipeline collect in substantial quantities under normal operating conditions. High volumes of incoming liquid due to variable production rates or due to running scrapers can be conveniently handled in the large capacity offered by the slug catcher.

The slug catcher—made of two sections of 20-in. pipe—receives most of the liquid brought in by the incoming stream although gas and some carryover liquid pass through a separator battery where the remainder of the liquid is removed from the gas.

The Burns plant is located near Horseshoe Bayou field, a short distance from East Cote Blanche Bay and about 22 miles southwest of Morgan City, La. The gas-condensate stream reaches it through a 20-in. line which extends 18 miles out to a United Gas junction platform in Block 32, Eugene Island area. Gas is received at this platform through gathering lines extending from Pure Oil Co., Sun Oil Co., and Magnolia Petroleum Co. platforms. Flow through the plant has averaged 140,000 M.c.f. of gas daily.

The stream entering the Burns plant arrives at a pressure of about 950 psi. while outgoing gas is held at a discharge pressure of 850 psi. Upon arrival at the plant, the incoming stream reaches a pair of tees just upstream of a scraper trap (Fig. 2). The gas flow, along with some liquids, is diverted through the first tee in the inlet line. This gas passes upward through three vertical conventional Peerless gas separators. The main liquid flow, meanwhile, continues on to the second tee where it is diverted into the slug catcher. This second tee butts up against the scraper trap and is the terminus of the inlet line.

Slug-catcher details . . . The slug catcher consists of two 500-ft. sections of 20-in. pipe. The two barrels are tied together at their inlets and liquid passes out through a common outlet line. The barrels are positioned with one about 3 ft. higher than the other and slightly offset from it in a horizontal direction. Both barrels are set in an inclined position, having a slope of 4 ft. in their total length. The high end of the slug catcher is near the tie-in with the incoming line, and the low end is near distillate collection and flash facilities.

The lower barrel is located below ground level for most of its length. An 8-in. line runs from the gas-transfer line to the separators back to the inlet of the slug catcher. Some liquids carried into the transfer line will thereby gravitate into the slug catcher. Another 8-in. line runs from the low end of the slug catcher to the inlet manifold of the gas-separator battery. This provides a vent to permit entrapped gas to escape from the slug catcher and return to the separators.

Slug-catcher operation . . . During operation of the facilities, liquid coming in with gas is diverted into the two slug barrels. This liquid will accumulate in the lower end of the barrels. These are each equipped with liquid-level controllers which automatically operate to permit liquid to be pressured into a high-pressure flash tank (Fig. 3). The barrels are also equipped with sight-gage glasses installed at intervals along their lengths to permit

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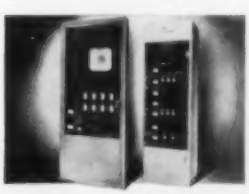

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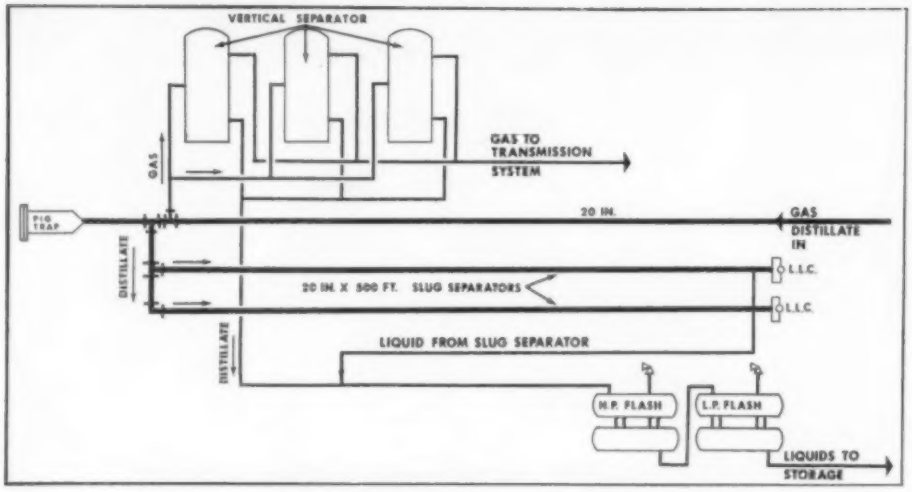


GAS FLOW is indicated at Burns plant.

a visual check of the liquid levels (Fig. 4).

The high-pressure flash drum operates at 380-psi. pressure. In addition to the liquids from the slug catcher, it receives liquids recovered from the three gas separators. Pressure is dropped again in a second-stage, low-pressure flash drum which is tied into the high-pressure drum in series flow. This operates at 50-psi. pressure, with distillate from this drum sent to storage.

Surge capacity . . . In practice, the slug catcher not only acts as a preliminary stage in recovering liquids, but also provides a high degree of surge capacity. Any slugging which might accompany sharp fluctuations in incoming flow can be conveniently accommodated by these facilities.

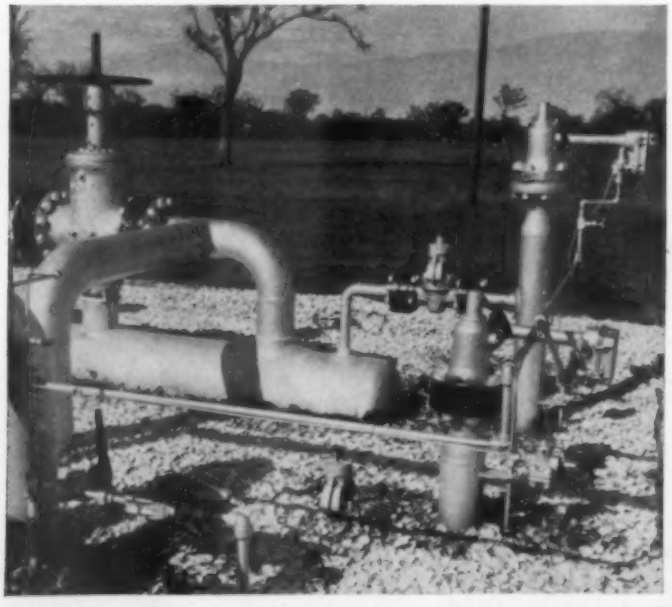
While dump valves are relieving the slug catcher of the high volume of incoming liquid, the slug catcher itself is able to "stack up" the surges. This has worked satisfactorily so that a dual dump-valve installation on the two flash tanks has not been required as originally thought. The dual arrangement would have provided for a second dump valve to function when volume entering the flash drums became excessive. This is not the case with the slug catcher installed.

In addition to handling the above type liquid slugs, the slug catcher also aids in pigging operations. Thus, when an almost solid plug of liquid reaches the plant ahead of a pig, the slug catcher again acts as a surge on the system.

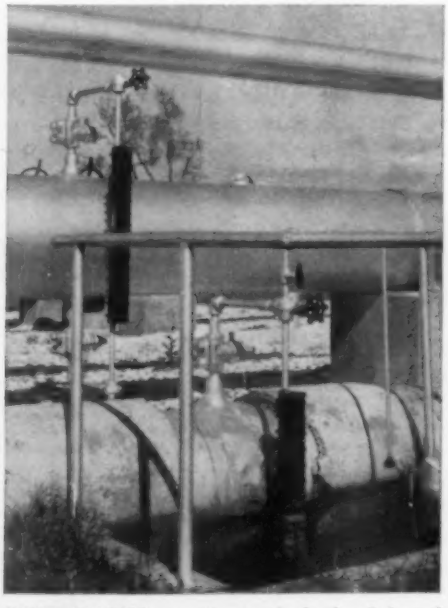
The Burns plant separation facility provides an added degree of performance reliability to the flow of pipeline-quality gas into the main transmission lines.

Acknowledgments

Cooperation of the management of United Gas Pipe Line Co. in the release of this information is gratefully acknowledged as is the assistance of Myatt B. Johnson and Y. Bert Olive, Shreveport; and Vernon L. Scharfe, New Orleans.



LIQUID-LEVEL controllers maintain level in barrels. Lower 20-in. barrel is below ground here.



SIGHT GLASSES permit visual check of barrel contents.

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For maximum reliability and to keep production moving despite the heat of temporary overloads—

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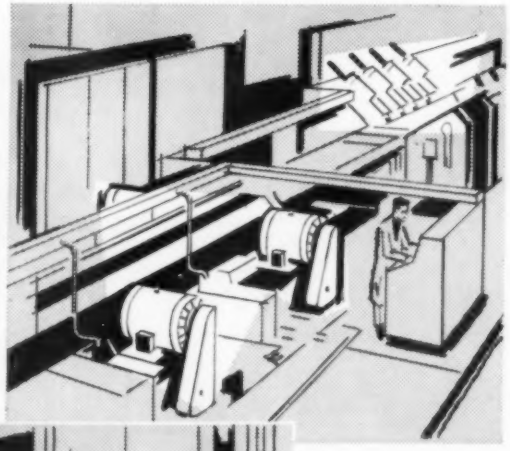
Write Dept. 843 for list of builders who offer Dow Corning silicone-insulated motors.



On production set-ups, where downtime is measured in lost profits, silicone-insulated motors keep going despite overloads.

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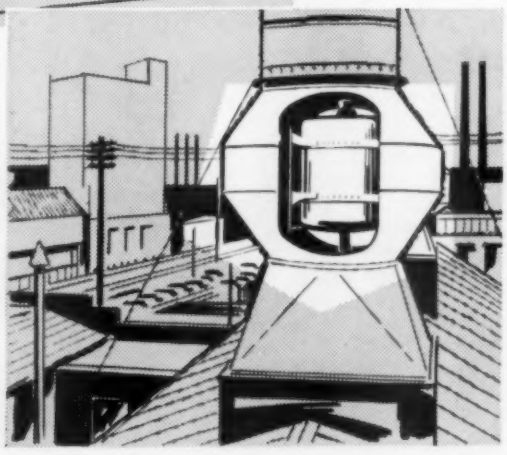

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FPC, courts tighten grip on gas

. . . but a limited area outside regulation remains by resorting to direct producer-distributor sales or overriding royalty deals

BY HENRY LIPPITT II
Southern California Gas Co.

EVER SINCE the Supreme Court's decision in the Phillips case, June 7, 1954, Federal Court decisions have affirmed a wider and wider scope of Federal Power Commission jurisdiction over the sale of natural gas in interstate commerce.

Phillips case . . . Briefly, the facts in the Phillips case concerned the sale of natural gas at high pressure from the tail gate of several gasoline-extraction plants. This gas was delivered from the wellhead in lines up to 20 miles long, and up to 24 in. in diameter.

The Supreme Court held that the tail-gate sales were jurisdictional, but used language to indicate "all wholesales of natural gas in interstate commerce, whether by a pipeline company or not and whether occurring before, during, or after transmission by an interstate pipeline company" were subject to the FPC's jurisdiction (Phillips Petroleum Co. vs. Wisconsin, 347 U. S. 672, June 7, 1954).

Fifth Circuit Producer Cases . . . The first cases to launch a frontal attack on the FPC's regulations implementing the Phillips decision were the so-called "Fifth Circuit Producer Cases." A series of major independent producers, Magnolia, Superior, Stanolind, The Texas Co., Union Oil, Humble, Hunt Oil and others sought to have the regulations declared invalid.

In a sweeping two-one opinion a panel of the Fifth Circuit (New Orleans) upheld the commission, June 30, 1956 (Magnolia Petroleum Co., et al. vs. Federal Power Commission, 236 F2d 785 et seq.). Further appeal to the Supreme Court was futile, certiorari being denied Jan. 14, 1957 (352 U. S. 968).

It was only at this point that most major independent producers recognized the general validity of the commission's new jurisdiction.

This general time also coincided with the Supreme Court's denial of rehearing, Nov. 19, 1956, in the Panhandle (pipeline) case—requiring costs to be presented as a factor in cases setting the scale for pipeline produced gas (City of Detroit, et al. vs. Federal Power Commission, 352 U. S. 919). It also coincided generally with the commission's initial independent producer rate decision, Dec. 6, 1956, to the same effect (Re Union Oil Co. 16 FPC 100).

Huber case . . . As if to foreshadow other cases to come, the commission was first upheld by the Court of Appeals for the Third Circuit (Philadelphia) in a case in which the commission had held that an independent producer could not abandon sales to an interstate pipeline company without approval of the commission (J. M. Huber Corp. vs. Federal Power Commission, 236 F2d 550). The Supreme Court later denied certiorari (333 U. S. 971, Jan. 14, 1957).

Deep South case . . . The next series of important jurisdictional cases were the so-called Deep South cases. In these cases the issue was the jurisdiction of the FPC to regulate the sale of natural gas on the lease, after passing through field separators, water "knock-out" devices and heaters.

Petitioners, Deep South Oil Co. of Texas, Shell Oil Co., Humble Oil & Refining Co., and Continental Oil Co., all argued in this series of related cases thas such sales (especially if they were for further "manufacture" or processing, and if the destination of the gas in interstate commerce was not specified in the sales contract) were still exempted by the "producing and gathering" exemption found in Section 1(b) of the Natural Gas Act in spite of the Phillips case.

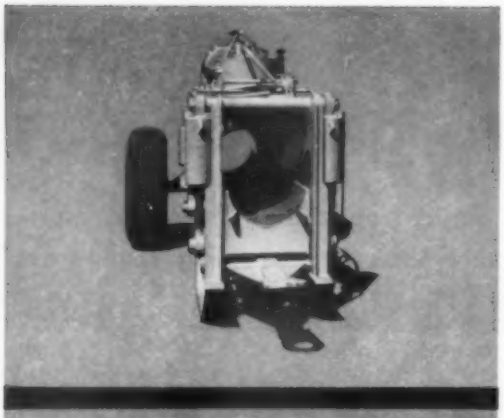
On June 29, 1957, a panel of the Court of Appeals for the Fifth Circuit (New Orleans) held otherwise 2-1—the minority judge filing a lengthy dissent (Deep South Oil Co., et al. vs. Federal Power Commission, 247 F2d 882, et seq.). Recently the Supreme Court denied certiorari in the appeals taken by Humble and Shell, Deep South and Continental having earlier determined not to appeal (Nos. 449, 459, Jan. 27, 1958).

Saturn case . . . Insofar as FPC jurisdiction is concerned, the last industry hope was centered on the so-called Saturn case. In that case the sale, by a small Kansas producer, was made "at the mouth of the . . . wells" into the seller's meter located in most instances on the christmas tree itself. In spite of the fact that eight oil and gas association filed briefs with the court in support of Saturn, a three-judge panel of the Court of Appeals for the tenth Circuit (Denver) affirmed the commission unanimously, Nov. 20, 1957 (Saturn Oil & Gas Co. vs. Federal Power Commission, F2d).

The eight associations joining the Saturn suit said that a victory for Saturn would mean "a victory for thousands of small gas producers far more sweeping than passage of the vetoed Harris-Fulbright bill or the new Harris bill now pending in Congress." On January 16, 1958, Saturn petitioned the Supreme Court. When the court resumes on March 3, Saturn's petition may well, however, be denied if previous trends are followed (No. 728).

State minimum price orders . . . Besides the FPC cases, the Supreme Court has recently been instrumental—with FPC assistance—in striking down state minimum field pricing orders. The first to go was the Oklahoma order specifying a minimum price initially of 7 cents and later 9.826 cents per M.c.f. (14.65 psia.) at the tail gate of a processing plant (Natural Gas Pipeline Co. vs. Panoma Corp., 349 U. S. 44, April 11, 1955).

The next to go—urged on by the FPC—was the Kansas Hugoton order specifying a minimum price of 11 cents per M.c.f. at the wellhead, which the Supreme Court threw out on January 20, 1958, holding in effect



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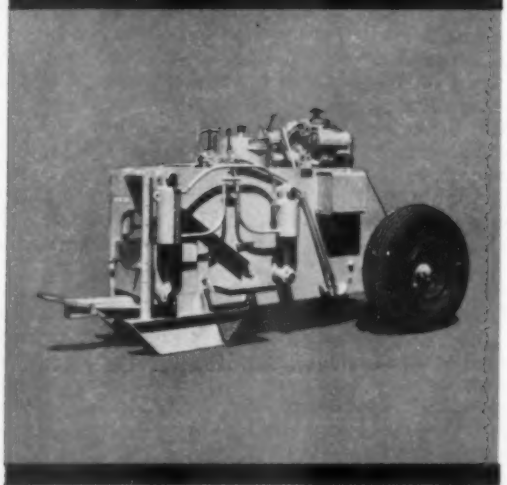

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that federal regulation preempted the entire pricing field for gas going into interstate commerce (Cities Service Gas Co. vs. State Corporation Commission of Kansas, U. S.). (See also: Michigan Wisconsin Pipe Line Co., Phillips Petroleum Co. vs. Corporation Commission of Oklahoma, to the same effect nullifying Oklahoma minimum price orders at the wellhead the following week (Nos. 86, 111, 112, 113, Jan. 27, 1958). No other states have sought to impose minimum price controls.

Summary . . . Generally, it may be said—with negligible exceptions—that FPC has been uniformly successful in asserting its regulatory jurisdiction since the Phillips case in every principal Federal Court of Appeals throughout the nation: third (Philadelphia), District of Columbia, fifth (New Orleans), eighth (Omaha) and tenth (Denver). The Supreme Court's actions during 1958 have confirmed these actions, although a multiplicity of other cases of lesser importance is still pending.

Present Situation

As a result of these successive decisions since Phillips the nonregulated area for the sale of gas by independent producers in interstate commerce has become increasingly narrowed. The only nonjurisdictional possibilities now appear to be (1) field sales of nonproducing gas leases containing gas in the ground, or (2) sales for direct consumption to a consuming buyer.

Field sale . . . The outright sale of a large block of nonproducing leases by a natural-gas company is probably still not subject to FPC jurisdiction—at least until such a time as production and flow are commenced into interstate commerce (Federal Power Commission vs. Panhandle Eastern Pipe Line Co., 337 U. S. 498 (1949).

If, however, the sale is made in installments, gas from the leases will already have started to flow into interstate commerce by the time the first installment is payable.

Thus, if the same producer were asked, as agent of the buyer (even on a cost-reimbursement basis) to drill and produce the purchased gas with delivery of custody by the agent (producer) to the buyer (distributor) at the wellhead, the "deal" would probably be too "thin" to survive FPC and court scrutiny—and would be held to be a wellhead sale, subject to FPC jurisdiction as in the Saturn case, above.

The remaining present possibility is to enter into a so-called "Delhi"-type deal in which the seller sells the gas to the buyer, actually transferring the leases, but retaining a clear overriding royalty of so much per M.c.f. (say 7, 8, 9 cents per M.c.f.) instead of the usual fractional royalty—one-eighth (Mid-Continent), one-sixth to one-fifth (California) or up to 40 per cent (Offshore Louisiana).

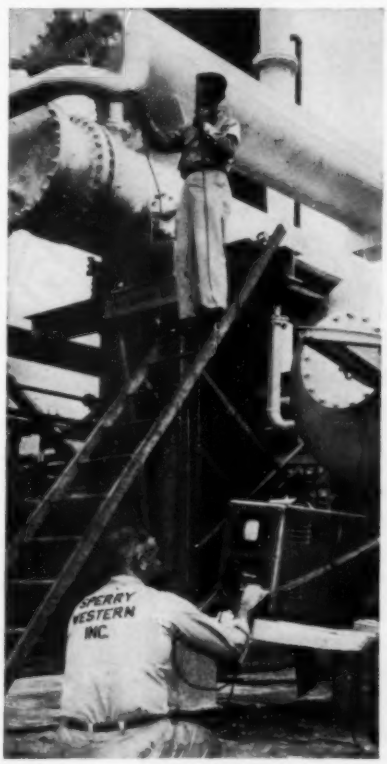
The buyer (distributor) then actually produces the gas, having an economic interest subject to depletion in it to the extent of his lifting costs (say 10 cents per M.c.f.). The total effective wellhead cost to the buyer (distributor) would thus be, say 17-19 cents per M.c.f.

This type of deal figured prominently in hearings in the present Phillips case before FPC. Presumably since the sale is one at the bottom of the well before any movement in interstate commerce has started the commission's staff consider it nonjurisdictional (Docket No. G-1148, et al, Testimony of Messrs. Cramer and Turner).

Sale for direct consumption . . . FPC's jurisdiction insofar as rates and

Solved:

The Case of the "Inside Job"



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charges are concerned is still presently limited in Section 1(b) of the Natural Gas Act to sales for resale in interstate commerce—although the present Staggers Bill in Congress (H.R. 7105, April 30, 1957; H.R. 8168, June 14, 1957) would amend this.

Accordingly, large users of natural gas for direct processing consumption —such as steam-electric generating plants, steel mills, and aluminum plants, etc.—may still purchase natural gas at the wellhead from independent producers, have it transported by applicable interstate pipe lines, and then consume it in their own plants. In such instances, FPC has only certificate jurisdiction over the sale in the field and the transportation in interstate commerce.

It also has rate jurisdiction over the pipeline-company transportation charges. It does not have jurisdiction over the contract price for the sale of gas in the field (since the sale is not one "for resale" as specified in Section 1 (b) of the Natural Gas Act). Accordingly in a typical deal of this type the steam-electric power company, for instance, may purchase the gas at the wellhead in the field, at say 18 cents per M.c.f. (nonregulated price), have it transported by the pipeline company at say a $1.80 demand charge and a 14 cents commodity charge for transportation (regulated), receiving the gas from the pipeline at a total typical 100 per cent load-factor cost of about 38 cents per M.c.f.

This type of deal is that presently involved in the following instances:

... Houston Texas Gas & Oil Corp., 16 FPC 118, 16 PUR 3d 333 (Dec. 28, 1956)—purchases by Florida Power Corp. and Florida Power & Light Co. in the field in Texas and Louisiana Gulf Coast areas are to be carried to Florida by the new Texas Florida pipe line [see: Florida Economic Advisory Council vs. Federal Power Commission, F2d (D.C. Cir. Dec. 4, 1957)].

... Transcontinental Gas Pipe Line Corp., Docket No. G-12059, et al (Examiner's Decision, Sep. 20, 1957; interim commission order, Nov. 29, 1957)—purchases by Virginia Electric Power Co. in the field in Louisiana are to be transported to Virginia by Transcontinental.

... Transcontinental Gas Pipe Line Corp., Docket No. G-13590, supplement filed Jan. 27, 1958—purchases by Consolidated Edison of N. Y. in the field in the Gulf Coast area of Texas are to be transported to New York by Transcontinental.

See, also, Transcontinental Gas Pipe Line Corp., Rate Schedules X-1, X-11, X-15—covering the transportation of Texas Gulf Coast gas owned by Sun Oil Co. to Sun's refinery at Marcus Hook, Pa.

In such instances, in issuing the necessary producer or pipeline company certificates, the commission may be asked to place price conditions—limiting the producers' prices—in the certificate [Signal Oil & Gas Co. vs. Federal Power Commission, 238 F2d 771 (3rd Cir. 1956) cert. denied 353 U. S. 923 (1957)]. The commission has, however, refused to do so in most recent cases [Re Continental Oil Co., et al, 17 FPC 880, rehearing denied 17 FPC 169 (1957); see also, Decision of Presiding Examiner in Re H. L. Hunt, Docket No. G-9553, et al, issued Jan. 24, 1958, and Re Sunray Mid-Continent Oil Co., United Gas Pipe Line Co., et al, Docket Nos. G-12211, G-12270, issued Feb. 3, 1958)].

The only caveat to this type of arrangement is that the FPC may consider such a transaction a sale and delivery of the gas in the field to the transporting pipeline company to be commingled with its other purchases. [Pennsylvania Water & Power Co. vs. Federal Power Commission, 343 U. S. 414, 419 (1952); State Corporation

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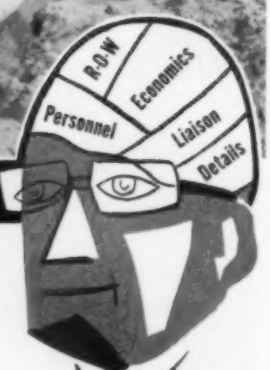

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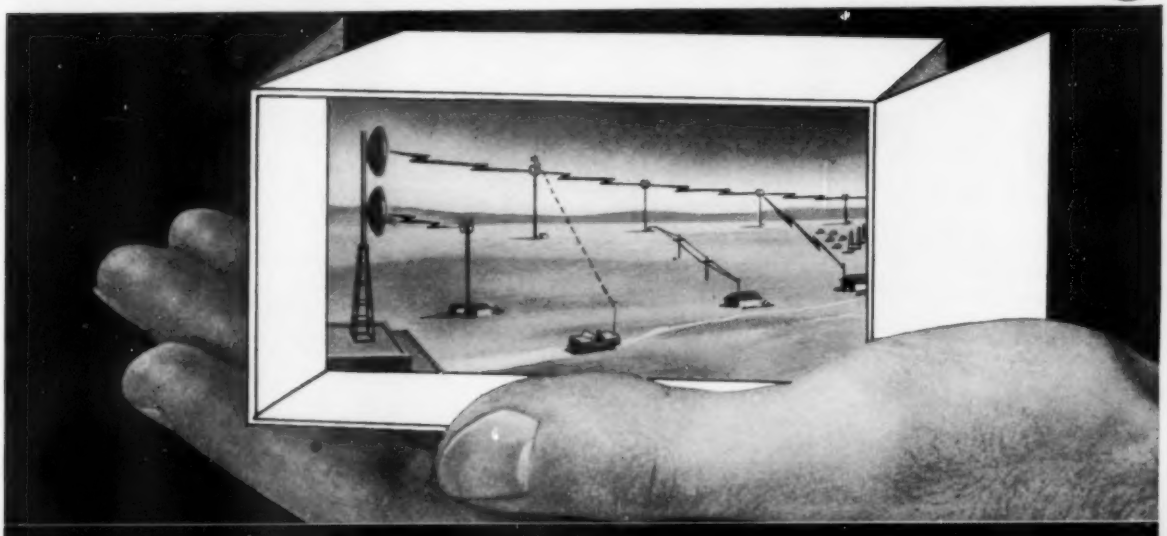

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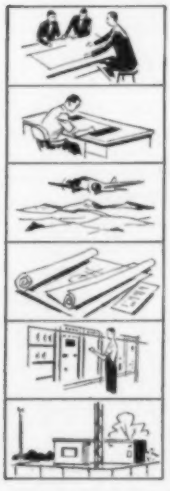

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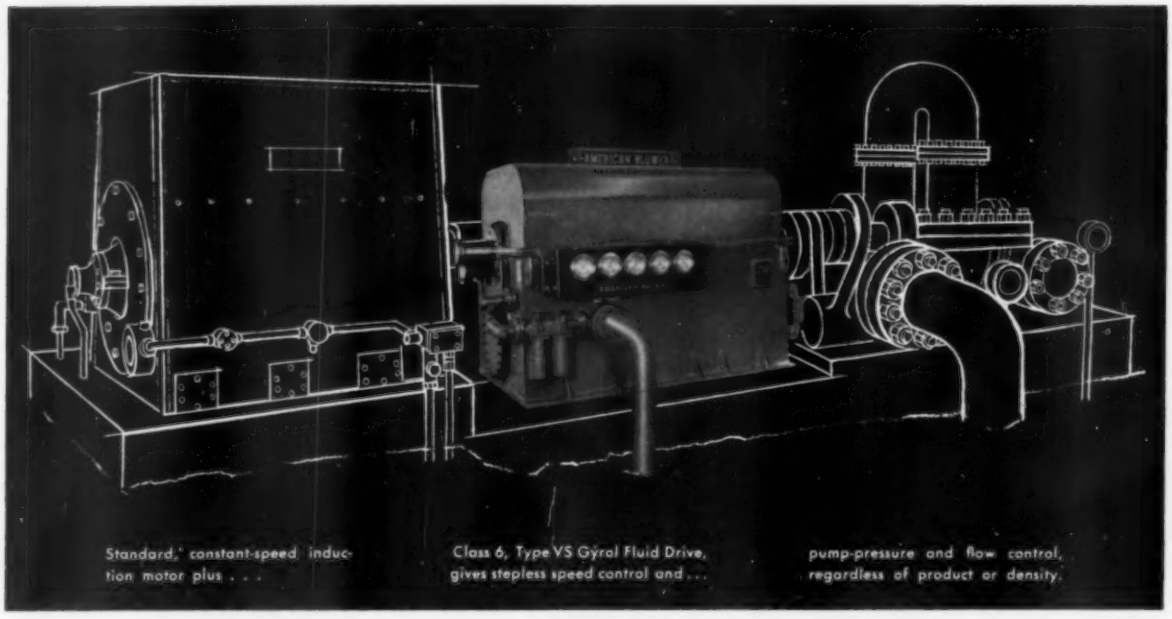
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Commission of Kansas vs. Federal Power Commission, 206 F2d 690, 699, 702 (Eighth Cir. 1953. 1953) cert. denied 346 U. S. 922 (1954); Panhandle Eastern Pipe Line Co. vs. Federal Power Commission, 232 F2d 467 (Third Cir. 1956) cert. denied 352 U. S. 891 (1956) and 236 F2d 289 (1956).]

There is, however, a definite line of cases making a division into different regulatory spheres of a commingled amount of gas sold or delivered under separate categories. [Colorado Interstate Gas Co. vs. Federal Power Commission, 183 F2d 357 (Third Cir. 1950); City of Hastings vs. Kansas Nebraska Gas Co., 221 F2d 31 (D.C. Cir. 1954) cert. denied 349 U. S. 920 (1955); State of North Dakota vs. Federal Power Commission, 247 F2d 173 (Eighth Cir. 1957).]

At least according to the Supreme Court the question appears to turn on "whether an essentially separate transaction is identifiable." [United States, et al vs. California Public Utilities Commission (California Electric Power Co., intervenor) 345 U. S. 295, 318 (1953).]

Accordingly, at the present time at least, such a sale directly to a consuming buyer may be made on a nonjurisdictional basis provided that it is clearly negotiated and documented as a separate transaction from the transporting gas-pipeline company's other gas-purchase transactions.

Conclusion

FPC's successes both in the Courts of Appeal and before the Supreme Court leave only a limited area for the nonregulated sale of natural gas for use in interstate commerce. Even if no legislation is enacted, however, producers may still be able to make nonregulated sales of gas for use in interstate commerce by selling reserves in ground en bloc to distributors, or by means of Delhi-type overriding royalty arrangements.

Nonregulated sales of natural gas may be made, to be transported to the buyer by interstate transmission companies at regulated rates.

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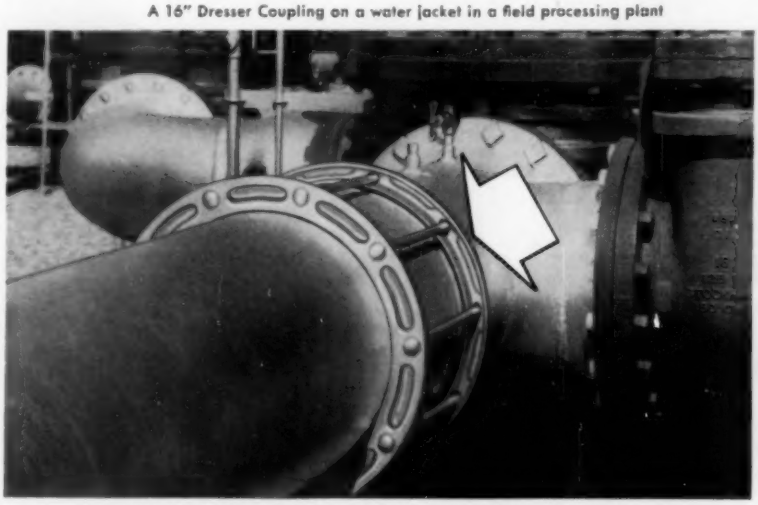

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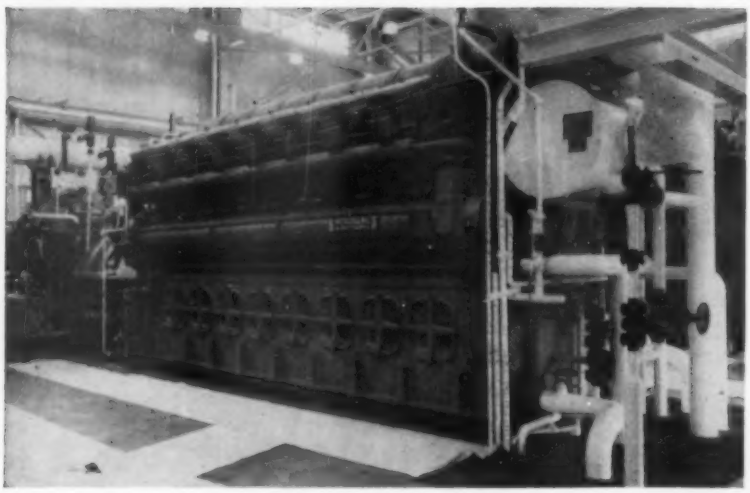

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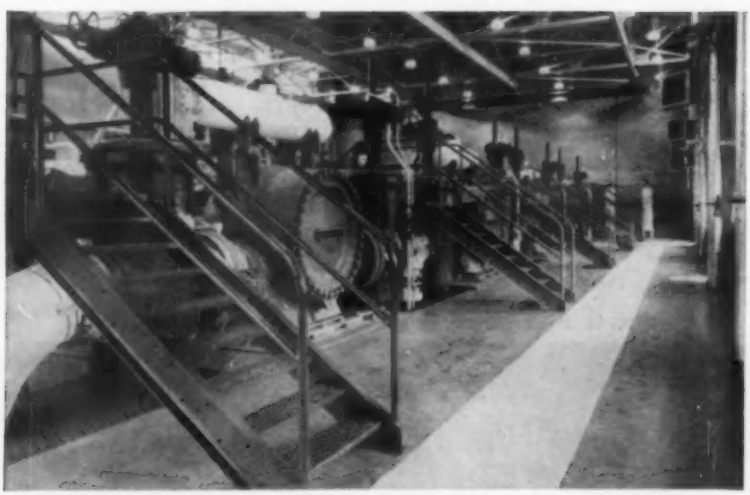

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Stations on this major new project feature thorough provision for automatic devices

BY R. W. BOEBINGER

ECONOMICS of flow-rate growth dictated the ultimate installation of eight compressor stations on the Westcoast Transmission system. One of these, utilizing reciprocating units, was spotted at Taylor, B. C., where the 30-in. main line begins. The station serves as a field compressor station. The other seven, using centrifugal units, serve as main line booster stations. They are spaced at intervals of aproximately 80 miles. For the initial phases of operation, the reciprocating station and three centrifugal stations, known as Stations 3, 5, and 7, have been constructed.

Station 3, at an elevation of 2,300 ft., is located near Fort McLeod, approximately 75 miles north of Prince George, B. C. Station 5, at an elevation of 1,750 ft., is located at Australian, 20 miles south of Quesnel, B. C. Station 7, at an elevation of 1,665 ft., is located at Savona, near Kamloops, B. C., at the west end of Kamloops Lake.

All three booster stations are similar in their basic design, with the exception that only three centrifugal compressor units are installed at Station 7. Four units are installed at both Stations 3 and 5. The location of these stations demands cold-weather design specifications, including 8-ft. frost depths, —50° F. ambient temperatures, and steels designed to meet a 15-ft.-lb. Charpy test at —50° F.

Series Operation

The centrifugal compressors are arranged for series operation, with the major gas piping system employing a "straight-through" type design. The units, along with their auxiliary equipment and the station utility facilities, are all installed in one building. A fire wall separates the main engine operating floor and basement from the office and auxiliary wing of the compressor building. The only other building in the station serves as a combination garage and shop, as well as a place for raw and treated water storage.

All three stations were constructed by Dutton-Williams - Stearns-Roger, with each station taking approximately 12 months to complete. Inspection was by Canadian Bechtel, Ltd., which managed engineering and construction for the whole system as agent for Westcoast Transmission Co., Ltd. Ford, Bacon & Davis, Inc., developed the detailed design for the stations. Because closing-out work is not complete, a statement concerning cost is impracticable at this time, but it is

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A Familiar Sign at Scenes of Progress

It was tough going for these 22-B hoes working on a 24-in. gas pipeline near Hawley, Pa. They excavated for a river crossing at the bottom of a gorge. Rock, quicksand, and a strong current call for machines that can do the job on schedule. Here, as on trenching jobs around the country, Bucyrus-Erie dependability pays off.

Built for rugged going, these 22-B hoes make a good showing as they trenched for the northern Ontario link of the trans-Canada pipeline. For about 78 miles through rock, mud, clay, and sand, these 22-Bs dug a 6½-ft. ditch. The line runs from the Manitoba border to Ft. William and Port Arthur, Ont. One of the men, who has operated Bucyrus-Eries since 1929, says it has been 15 years since his machine bogged down.

Bucyrus-Erie 22-Bs are fully convertible in the field from hoe to clamshell and other front ends. These clamshells cleaned out a pipeline trench and worked on a road approach in Saskatchewan, Canada. One clamshell is shown moving up as the other digs.

On both sides of the border, Bucyrus-Eries are gaining favor with pipeline contractors because of their ability to perform well under tough conditions. Here a 22-B hoe teamed up with a 22-B dragline to dig trench across the South Saskatchewan River for a 12-in. gas pipeline. The job site is near St. Louis, Sask., Canada.

About the project

Westcoast Transmission Co., Ltd.'s, 30-in. main line running from the Peace River district of British Columbia to the international border near Vancouver, B. C., is 650 miles long. Initially, the system will handle 400 M.M.s.c.f.d. With additional horsepower, the system's ultimate capacity will be 660 M.M.s.c.f.d. Both in the initial stages of operation and in the maximum design stage of operation roughly 85 per cent of the sales volume of gas moves through the entire length of the system. This volume includes sales to British Columbia Electric Co. for the greater Vancouver area, and to the Pacific Northwest Pipeline Corp., which serves the Pacific Northwest area of the United States. With a 90 per cent load factor and pay load at the end of the line, the centrifugal-type compressor unit has an application.

R. W. Boebinger is assistant chief engineer for Westcoast Transmission Co., Ltd. He graduated from New Mexico A. & M. in January 1951 with a B.S. in engineering. He joined El Paso Natural Gas Co. as a junior engineer in September 1951. In October 1955, he moved to Vancouver to work for Canadian Bechtel, Ltd., as a senior engineer on the Westcoast project. He has been with Westcoast since July 1957.

believed that cost per horsepower installed will run more than similar installations in the United States. The lengthy construction period caused by climatic conditions and the higher prices for material are the two major factors contributing to this higher cost.

Engines and Compressors

Westcoast's engine-driven centrifugal unit consists of a Nordberg high-pressure, supercharged, V-type, FSE-1316-HSC, four-cycle gas engine driving a De Laval BLV-24x24, single-stage centrifugal compressor. The engine drives the compressor through a single-step speed-increasing gear with a 10:1 ratio. The engine has 16 cylinders with a bore of 13½-in. by 16½-in. stroke, and is rated at 3,550 b.hp. at 500 r.p.m. The speed increaser is manufactured by Ferro-Birmingham, and is mounted on an extension to the main engine bedplate. The design point of the compressor is at an adiabatic head of 6,000 ft.-lb. per lb., with an inlet volume of 5,400 cu. ft. per minute.

Testing . . . The tests on the engine, prior to shipment, were conducted in accordance with the latest revision of the ASME Power Test Code PTC-17-1949 for internal-combustion engines whenever applicable. The tests conducted were classified into three groups: (1) a normal shop test on all 11 engines, (2) a continuous 4,500-hp. test of one engine for a period of 1 week, and (3) a complete test of one engine and speed-increaser unit.

The normal shop tests consisted of operating the engine at various speeds, and at load intervals from 0 to 110 per cent rated load with the engine connected to a calibrated hydraulic dynamometer. On the complete engine-speed increaser test, a range from 50 per cent below to 10 per cent above rated speed was covered with loads corresponding to the operating range of the compressor.

In testing the centrifugal compressors, the ASME Test Code PTC-10-1949 was followed in setting up the suction and discharge piping, positioning suction and discharge pressure and temperature connections, and positioning the impact tubes at the nozzle. Mechanical tests were run at rated speeds to demonstrate running qualities, freedom from objectionable vibration, and adequacy of lubrication. Performance tests were run on air at a speed which simulated the pipeline operating conditions for which the compressor was designed.

The efficiency in the air tests at atmospheric pressure was determined by the adiabatic temperature-rise method using instrumentation in accordance with the ASME specifications. The performance tests on the compressor were run at an equivalent aerodynamic speed rather than full speed, because it was one way that pipeline operating conditions could be simulated when using air as the testing medium.

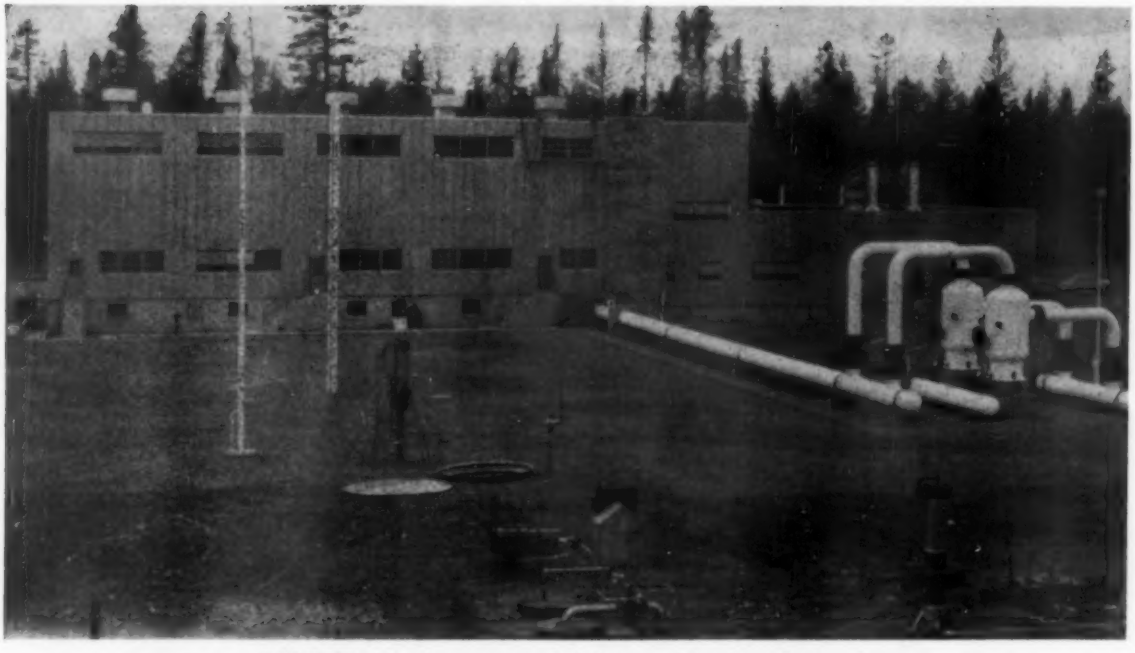
Lubrication, cooling, fuel . . . The engine-driven centrifugal unit employs two separate lubricating-oil systems. One system is for the main engine, and the other, known as the "accessory lube-oil system," is for the compressor and speed increaser and their associated equipment. In both systems, full-flow-type filters are installed and a bypass filter is included in the main lube-oil system. Also in both systems, standby pumps are installed for all services.

The jacket-water system is a closed, blended, circulating-type system. Only one pump is used, and two lubricating-oil coolers are also included in the circuit. The coolant consists of a 50 per cent glycol solution in order to cope with the low ambient temperatures existing during wintertime operations. A forced-air-type fin-fan unit is used for dissipating the heat.

Fuel gas is delivered to the engines at a pressure of 50 psig. The gas flows through a fuel-gas filter, a shutdown control valve, a pressure regulator, and flow indicator before going to the engine. Starting air is supplied at 250 psig.

Controls

The engine controls are designed for "semiautomatic" operation, with the whole startup procedure controlled from an engine gage board. When the operator pushes a button, the controls carry the unit to a "prestart" condition with no further action required. Before pushing the prestart button, the operator must, however, take several steps. He checks the auxiliary equipment which is to oper-



GAS-INLET side of compressor building is pictured on Station 5.

ate, and turns selector switches at the various pumps to "automatic" positions. These pumps include the engine lube-oil pump, crankcase vacuum pump, air-filter pump, accessory lube-oil pump, seal-oil pump, and auxiliary seal-oil pump.

Unit discharge and suction valves also have selector switches that need positioning. The standby engine lube-oil pump and standby accessory lube-oil pump selector switches are turned to "off" positions. The compressor-case vent valve is opened, the unit bypass pressurizing valve, unit discharge, and unit suction valve are closed and all auxiliaries are off. The operator also checks all valves in the water, oil, fuel, and starting lines for proper setting.

All intelligence devices for the unit, both alarm and shutdown, are the normally closed type, and all relays are energized during normal operation, thereby giving fail-safe operating conditions.

Startup sequence . . . After the preliminary checks are complete, the operator then initiates the startup sequence by pushing the prestart button located on either the engine board for the particular unit, or on a main station console located in a control room in the auxiliary wing of the building. The crankcase vacuum pump, air-filter pump, and main engine lube-oil pump all start simultaneously.

The accessory lube-oil pump starts when the oil temperature at the discharge of an accessory lube-oil tank reaches 90° F. A hot-water-heating coil is located in the accessory lube-oil tank to bring the oil up to this temperature. When the oil from the accessory lube-oil pump reaches 20 psig., the main seal-oil pump and the auxiliary seal-oil pump start. When the pressure on the discharge of the main seal-oil pump reaches 225 psi., the auxiliary seal-oil pump shuts down.

When a "high" level switch in the seal-oil tank closes, indicating that the tank is full, the unit bypass pressurizing valve opens to pressurize the compressor case. After a time delay of 30 seconds, the unit vent valve closes. At the time when the case and the main gas bypass header are at the same pressure, the unit discharge valve opens. When the discharge valve is in a 1-in. position, the emergency shutdown controls, alarm and shutdown annunciator system, fuel solenoid valve, and an ignition time-delay relay are energized.

The ignition on the unit does not come on until after the engine is purged and gas is turned on. When the unit discharge valve is completely open, a blue light on the engine and station console boards announces that the prestart sequence is complete. The blue light remains on while the engine is operating under normal conditions.

The entire prestart sequence is so interlocked that if any of the steps in the sequence have not been completed, the light signal will not come on. After the discharge valve is open 1 in. and the alarm and shutdown circuits are energized, any fault is indicated on the engine board. There are 14 separate shutdown and 9 separate alarm signals indicated on an annunciator panel located on the engine control board. If a shutdown device operates, a shutdown procedure is initiated and the unit is returned to a complete shutdown condition.

If the accessory lube oil is heated prior to startup, the entire prestart sequence takes approximately 6 minutes. Starting air and fuel-gas controls are also on the engine gage board, and from this position the operator starts the engine. After the engine is running, the operator may open the compressor-unit suction valve by pressing either of two buttons on the engine board. One button is an inching button and the other is a full open button. When the suction valve is in the full-open position, a red light shows on top of the engine board and a limit switch closes the unit bypass valve.

The operator may start the jacket-water circulating pump from a push-button station on the engine panel board at any time, either before or after the engine has started, depending on temperature conditions. There is one standby jacket-water pump for the four engines, and it must be started locally when needed. The fans for the jacket-water coolers are started from push-button stations located under the coolers.

A 16-in. station bypass line is avail-

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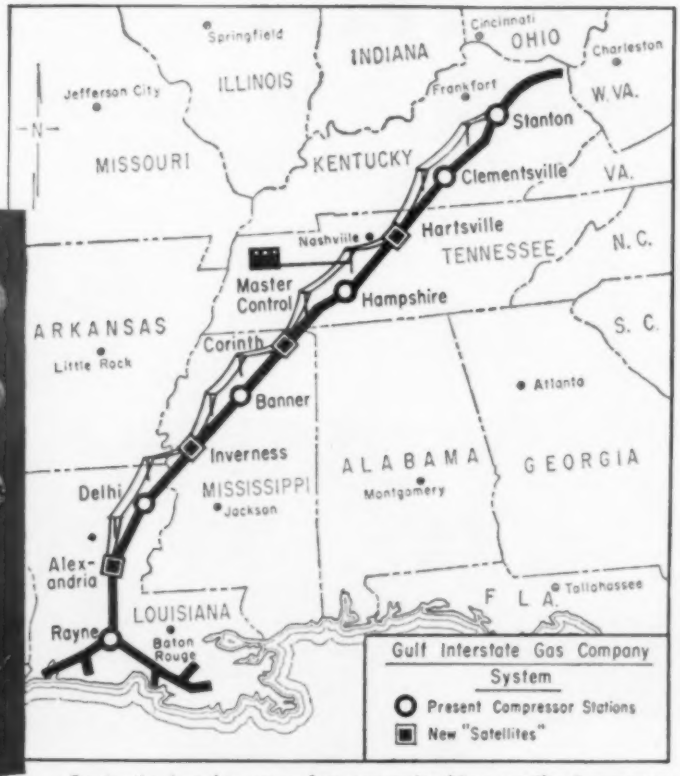
Gulf Interstate's unattended "satellite" station shows how UNION C.T.C. lowers costs with safety and reliability.

UNION Control Panel at Stanton, Ky.



Construction is under way on four new engine-driven centrifugal compressor stations. All will be remotely controlled unattended "satellites." Operations will be directed from a UNION master control panel near the center of the system.

The Gulf Interstate Gas Company's "satellite" station at Stanton, Kentucky provides most economical and safe operation, according to Mr. R. Lo Chiano, assistant chief engineer at Gulf Interstate.

The Stanton station is remotely controlled from Clementsville, Ky., 90 miles away, through a UNION Centralized Transport Control System and has been on completely *unattended* operation since June 1956. This system is unique because it provides remote control and indications for a turbocharged engine driving a centrifugal gas compressor . . . the first installation of its kind. Large savings result because the operator at the master station can change the set point on the discharge pressure controller and start and stop the engine at Stanton.

Another important saving is obtained because the UNION C.T.C. System uses only one leased line circuit to transmit all the controls, indications and telemetering data. The control system used permits the use of the lowest-cost circuit. This installation was "custom engineered" using standard UNION components to meet the particular requirements.

The unattended station is definitely successful. There have been no false shut-downs that were not man made. With this in mind, future stations are being patterned after the one at Stanton.

Write for further information on UNION C.T.C. for all types of pipelines, gathering systems or tank farms. Ask for Bulletin 1052.

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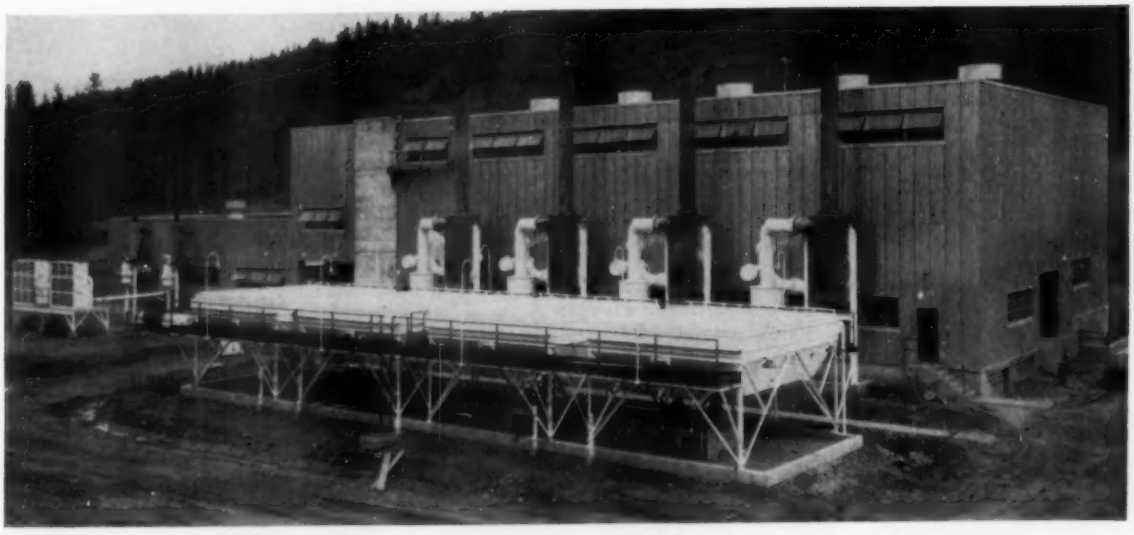


JACKET-WATER cooling side of compressor building is shown in this view.

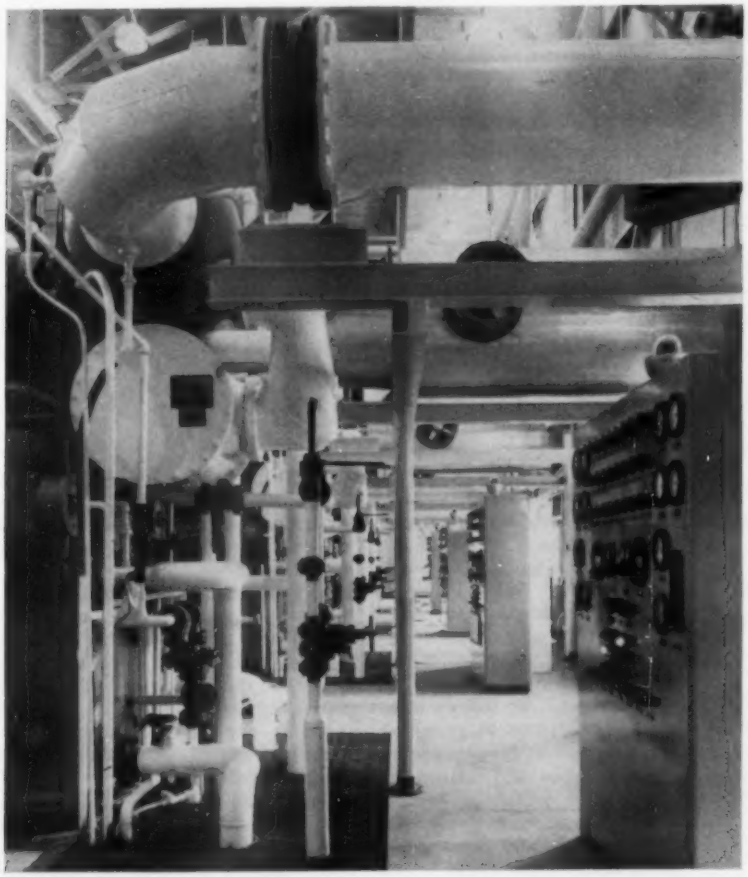
able for surge control. The 16-in. valve in this bypass can be opened or closed from each engine board. Indicating lights on the boards show when the valve is fully opened or closed.

Alarm system . . . If an alarm intelligence device operates, a red light on top of the engine board flashes. Also, an amber light on the engine annunciator panel flashes, indicating the source of intelligence, and a compressor-unit master light on the main station console flashes.

Simultaneously, an "on" and "off" signal is given by a howler in the compressor room and auxiliary wing and by a buzzer in the main control room. The operator can then press a horn reset button located on the engine board which will silence the audible signal. If the faulty condition can be rectified, the intelligence circuit will reestablish itself automatically.

If a shutdown intelligence device operates, the red light on top of the engine board goes out. Also, a red shutdown light on the engine annunciator panel comes on, indicating the source of shutdown intelligence. The unit light on the main station console also goes out. Simultaneously, a continuous signal is given by the howler in the compressor room and auxiliary wing and by the buzzer in the main control room.

When the operator presses the horn-canceling button to silence the audible signal this time, the red light showing the source of shutdown intelligence on the engine annunciator remains burning and stays locked in this position. The annunciator panel remains locked, showing the cause of shutdown until the opening of the discharge valve in the next prestart cycle unlocks it and inserts the alarm and shutdown devices into the shutdown circuit.



ENGINE GAGE boards and control valves are seen inside compressor building.

Shutdown sequence . . . In the shutdown sequence, when a shutdown intelligence device operates, the annunciator system operates as previously described and the shutdown sequence is initiated. A solenoid valve in the fuel supply to the engine closes,

Operation

and the unit suction valve closes. After a short time delay to permit burning of all gases in the engine, an ignition relay deenergizes and grounds the pulse generator.

When the suction valve is full closed, the discharge valve closes. After the discharge valve is full closed, a vent valve opens, venting the compressor case. After the vent valve is full open, all of the auxiliaries to the engine stop, except the jacket-water pump and jacket-water cooler fans which must be stopped manually.

For an intentional shutdown, the operator presses a normal stop button located on either the engine board or main station console and the shutdown will be identical to that described above.

The engine and speed increaser are mounted on rails imbedded in the foundation. Based upon the experience of the engine manufacturer, it was felt that the inherent thermal expansion of the engine could least be restricted on this type of foundation. The rails are 14-in. I-beams, and so far the installation seems to be satisfactory.

Early Experience

There have been the usual problems encountered in starting up the new system. Initial flows in the first few months of operation were below the operating points of the compressors, but operation could be continued by utilizing the 16-in. station bypass for recirculating the gas.

In the start up sequence of operation, the compressor case is pressurized prior to startup of the engine. From experience to date, it is believed that the compressor is brought into operation under a "dry-start" condition. The shaft in moving out forces the lubricating oil from the thrust bearing, and the bearing is not properly lubricated at the beginning of rotation. Design changes are being made which will interrupt the sequence at the time when the seal-oil tank is in a safe operating condition. The operator will then be permitted to start the engine before the sequence is continued and the case is pressurized.

A hot-water-type heating coil is used in the accessory lube-oil tank for heating the oil prior to startup of the compressor. There has been a leak in one of the coils, allowing water to leak into the system. It is felt that electrical heating elements may be used in future installations.

Glycol has been used in the coolant for the jacket-water circulating system. With quite a bit of down time in the first few months of operation for adjustment of the equipment and because of an intermittent load, this approach has been beneficial. Because of the presence of the glycol, the operator has not had to drain down his system in cold-weather operation each time he has shut down the unit.

Due to the design of the engine power cylinder jackets, there is little possibility of water leakage into the engine lubricating-oil system. After more operator experience is gained, and when there can be continuous operation, the glycol will probably be removed from the system.

In the majority of cases, each unit was "run in" only a few hours prior to going on line. Only tune up adjustments and minor tests were made. A plan now being developed calls for running field installation tests on the units to determine performance characteristics. The scheme being devised will accumulate data similar to the information obtained in the standard ASME tests run in the shop on centrifugal compressor units. By correlating this data with engine fuel-consumption information, the performance of the entire unit for field operation will be established.

Auto "doctors" use stethoscope

AUTOMOTIVE engineers at Shell Development Co.'s research center, Emeryville, Calif., are using a stethoscope to listen to the heartbeat of experimental automobile engines.

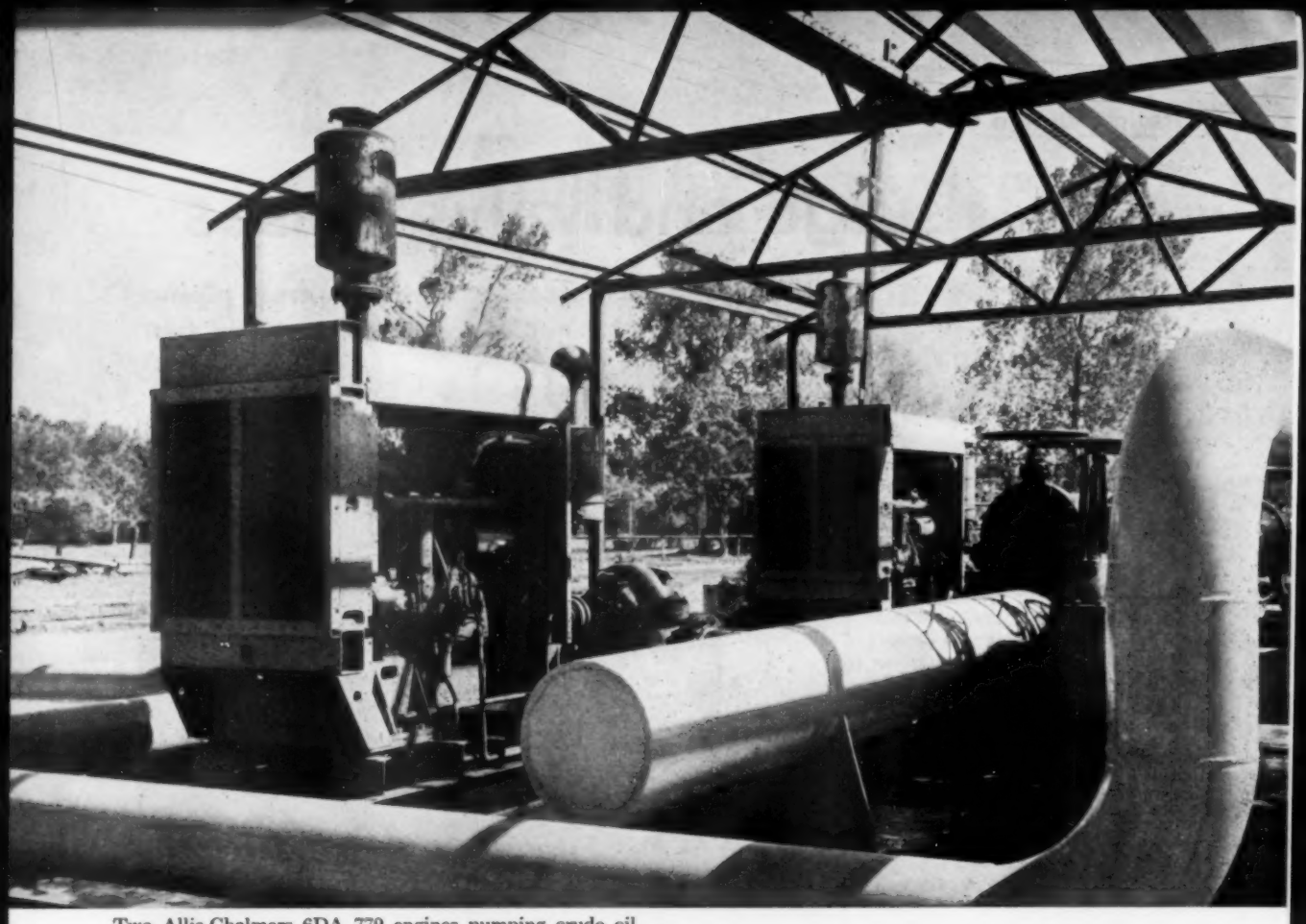
Cars are operated with 12:1 compression ratios both on Bay Area freeways and on a chassis dynamometer which simulates road conditions in the laboratory.

When a car travels on today's freeways for long distances at sustained high speeds it tends to develop engine operating difficulties not known at average speeds.

To listen to the noises engines make under these conditions, Shell engineers use a stethoscope. These noises are called "high-speed knock."

High-speed knock is caused by abnormal fuel combustion at sustained high speeds, particularly on long uphill pulls. The flame wall in the combustion chamber, ignited by the spark, moves across the chamber. The unburned fuel is compressed, heated and ignited spontaneously. The resultant vibration is called "knock." This knock can ruin an engine if allowed to persist.

Shell's engineers are engaged in studies of this phenomenon to make recommendations for fuels of the future. These will be available when new cars will be traveling at faster speeds for longer periods as the federal highway construction program gets under way.



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ALLIS-CHALMERS

80-7

How to reduce surge and valve losses

Modifications cut horsepower losses from piping surge and compressor valves, lowered fuel consumption 12 per cent.

BY C. S. KENWORTHY

WHEN WE SUPERCHARGED our Worthington and Cooper-Bessemer 24 by 36 horizontal gas engines, we increased compressor-cylinder diameters from 13⅛-in. to 15¾-in. And we were aware from the beginning of the supercharging program that there were two possible unsatisfactory situations which could thus be created in the operation:

... Piping surge problem. Even when operating with the original 13⅛-in.-diameter cylinders, the pressure surge had been extremely severe. This situation was covered in an AGA paper in 1942. With the two individual 6-in. suction and discharge lines on the 1931 Worthingtons and the one 8-in. on the 1947 Worthington and Cooper-Bessemer units there was bound to be a serious surge problem.

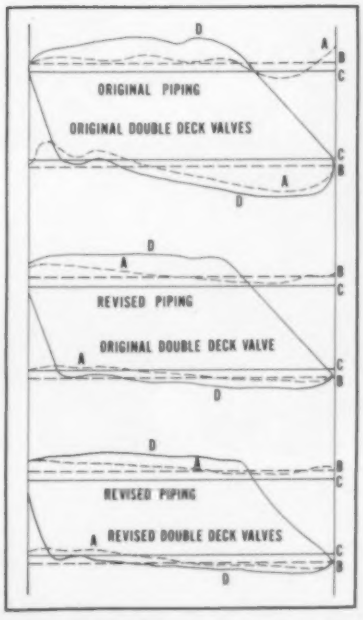
... Compressor - valve problem. It was also recognized that an increase in valve velocity of almost 50 per cent would increase the compressor-valve loss from approximately 4 i.c.hp./M.^{2} (indicated compressor horsepower per million cubic feet of gas pumped) to double that amount. Such a high valve loss could not be tolerated, and it was decided at the start of the project to purchase double-deck valves from the engine-compressor manufacturers.

Tests to Determine Losses

Shortly after the first 15¾-in. cylinders were installed in May 1957, tests were conducted to determine the effect of surge upon the capacity, horsepower loading, and horsepower losses, and also to check the valve losses with the double-deck valves and to improve their performance if possible.

To separate the surge and valve losses satisfactorily required that indicator cards and pressure data be taken with an MIT indicator and furthermore that extreme care be taken in its operation. This indicator was also used to record the station suction and discharge pressures.

Author is general superintendent of compressor stations, Natural Gas Pipeline Co. of America, Chicago.



PIPING AND VALVE losses are shown. Fig. 1.

Indicator-card data (Fig. 1) . . . The pressures (dotted lines marked A) were taken just outside the cylinder. The average pressures (dotted lines marked B) are taken from the pressure-time diagram and recorded as shown on the pressure-displacement diagram. The station suction and discharge pressures (lines marked C) are similarly shown. The net positive area between lines A and C is a measure of the total station piping losses. The suction and discharge pressures in the cylinder are denoted by the letter D. The net positive area between the lines D and A is a measure of the compressor valve losses.

The top indicator card is representative of the operation of the compressor cylinders with the original piping and the double-deck valves as first installed. The extreme pressure variations as indicated proved the desirability of reducing the piping surge.

PULSATION BOTTLES reduce surge loss. Fig. 2.

Reduction of surge losses . . . The surge problem was reviewed with the Southwest Research organization, using the analog. Pulsation bottles, as shown in Fig. 2, were then installed on the original units erected in 1931. The bottles were located as close as possible to the compressor cylinders on each set of individual suction and discharge piping.

A practically equivalent arrangement was used on the newer units (erected in 1947), both Worthington and Cooper-Bessemer. The total surge loss with the original piping was 0.7 i.c.hp./M.^{2} With the pulsation bottles, this loss was reduced to approximately 0.35, a reduction of 0.35 i.c.hp./M.^{2} This improvement is certainly understandable when the huge difference in velocities is considered.

Prevention of Extreme Supercharging

The pulsation bottles accomplished an even greater reduction in horsepower requirements by preventing the extreme supercharging of the compressor cylinders, under certain speeds and other operating conditions. This supercharging previously caused the capacity as well as the horsepower to increase in some instances as much as 10 or 15 per cent. Although this

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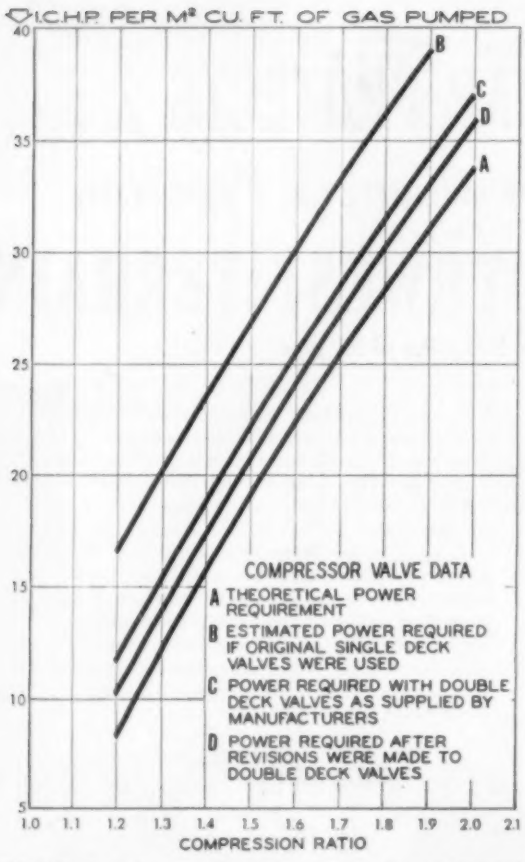


CURVES show improvement in horsepower requirement after valve revisions. Fig. 3.

effect, in itself, does not increase the horsepower required to pump a given amount of gas, it does cause the engine to be subjected to undesirable overloads. It also makes it almost impossible in normal operation to properly check the horsepower and fuel consumption of the engines.

The pulsation bottles reduced the supercharging effect to approximately 2 or 3 per cent. To have made any further improvement would have required extensive changes in the compressor piping with very considerably increased costs.

Reduction of Valve Losses—Cooper-Bessemer Units

The double-deck valves supplied by Cooper-Bessemer Corp. were specified to be channel type. More or less in line with the practice followed with plate-type valves, the valves were limited to only 3/32-in. lift. This caused the area under the valves to be only 75 per cent of the port area through the seat. In addition the spacer used to separate the top and bottom valves was cast with excessive metal sections resulting in a restricted area.

The valve lift was increased to ⅛ in. and a new set of distance pieces was machined which greatly reduced the restriction at this point.

The above modifications were tested in September 1957 as follows:

Run No. 1 original valves (not modified).

Run No. 2 modified spacer plates installed.

Run No. 3 modified spacer plates and new high lift (⅛-in.) guards installed. I.c.hp./M.³ valve losses calculated from the pressure-displacement diagrams and tabulated below indicate the improvement which was attained.

An over-all reduction in valve loss of 1.25 i.c.hp./M.³ was obtained. When it is realized that the capacity of each engine-compressor unit after our newest expansion program is completed will be approximately 100 M.³ cu. ft./day, the reduction in valve loss takes on real importance. It represents 125 i.c.hp. per unit, or a total of 1,250 i.c.hp. at each 10-unit station. This is a 7 per cent reduction in load per unit, and a similar reduction in fuel consumption.

	Suction valve loss	Discharge valve loss	Total valve loss
Run No. 1	1.58	1.60	3.18
Run No. 2	1.38	1.42	2.80
Run No. 3	1.05	0.88	1.93

The bottom indicator card in Fig. 1 shows plainly the total reduction in valve loss which was obtained.

Projecting the above data to a variable number of compressions, and assuming that the i.c.hp./M.³ loss is practically constant over a range of compression ratios, the curves shown in Fig. 3 were obtained. Curves D and C show graphically the improvement indicated in the above tabulation.

Curve B shows approximately the conditions which would have been encountered if the original single-deck valves had been used.

Reduction of Valve Losses—Worthington Units

A study of the flow areas through the Worthington valves indicated that there were several possible critical flow areas through the valve, as follows:

1. The area under the valve strips was only 63 per cent of the area through the seat.

2. The area between the edge of the valve strip and the silencing strip was similarly only about 60 per cent of the valve seat area.

3. The flow area through the bottom deck valve to the top valve was about 65 per cent of the area through the top valve. This restriction was more severe in the case of the suction valve where a strengthening rib in the bottom valve guard further reduced this area to about 48 per cent of the seat area of the top valve.

4. The design of the yoke holding the valve in place also appeared to somewhat restrict the flow through the yoke.

Revisions designed to improve each of the above conditions were made on a set of valves and tested.

1. To alter the first critical flow area, two modifications were tested:

(a) A 0.032-in. spaced plate was installed between the valve seat and guard. This increased the area under the valve strip by giving the valve strip an additional initial lift of 0.032-in.

(b) The thickness of the valve strip material was reduced as follows:

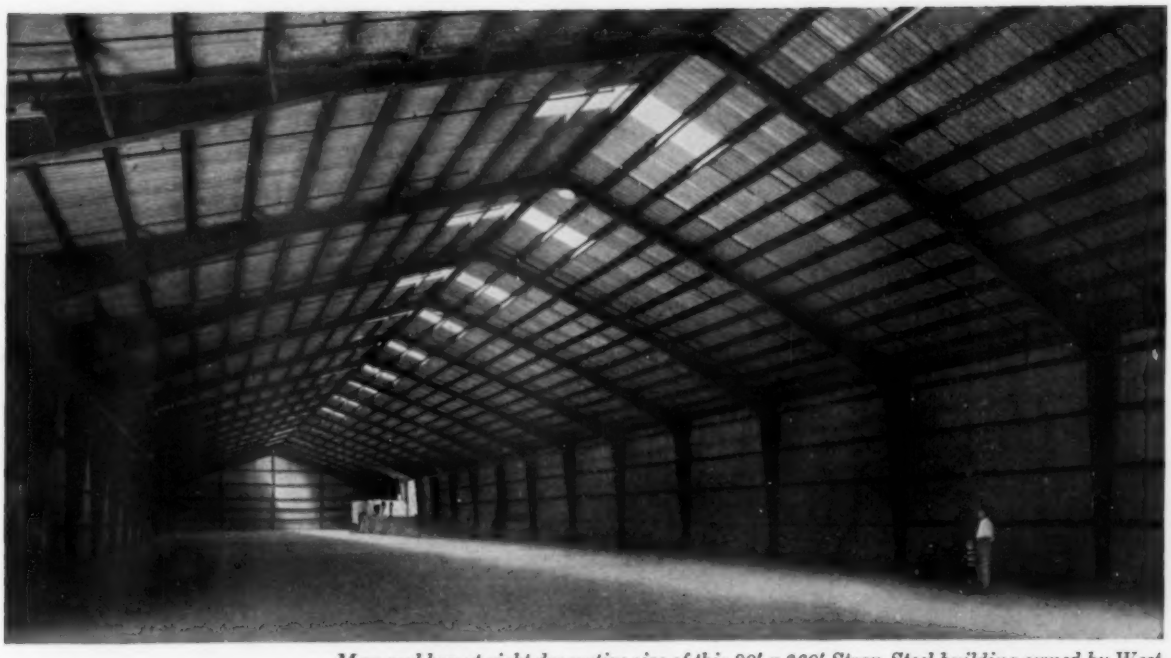
Thickness as supplied: two short strips 0.040-in.; two intermediate strips 0.050-in.; three long strips 0.056-in.

The thickness of all strips was reduced to 0.035 in., thus increasing the flow area under the valve strips to 82 per cent of the valve-seat area.

2. To alter the second critical flow area the silencing strips were removed from the valves. These strips are 0.052 in. thick and their removal increased the flow area at this point to 76 per cent of the seat area.

3. To alter the third critical flow area the straightening rib, which has been shown to be unnecessary, was removed from the lower suction-valve guard.

4. To alter the fourth critical flow area the yokes on both the suction and discharge valves were machined to provide a greater flow area under the yoke, and to reduce the turbulence.



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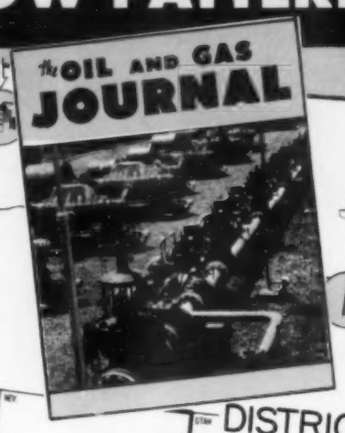
FLOW PATTERNS AND CAPACITIES OF U. S. PIPELINE SYSTEMS



THOUSANDS OF BBL. DAILY

DISTRICT 5

DISTRICT 4

DISTRICT 2

DISTRICT 1

DISTRICT 3

Legend

CRUDE OIL PRODUCING AREA

REFINING AREA

PLANNED OR UNDER CONSTRUCTION

CRUDE OIL PIPELINES

- Principal movements are from producing areas in PAD Districts 2 and 3 to refineries in the Mid-Continent and Gulf Coast areas, and to Gulf Coast marine terminals.
- From Producing areas in District 3, there is 4,140,000 B/D capacity into Gulf Coast refineries and terminals, and 1,221,000 B/D to Mid-Continent refineries.
- Crude production from District 2, supplemented by receipts from Districts 3 and 4 and Canada, supplies major refining centers in the Great Lakes, Wood River, and Kansas-Oklahoma areas. Capacity to Great Lakes refineries is 1,373,000 B/D, to Wood River refineries 737,000 B/D.

DISTRICT 5

DISTRICT 4

DISTRICT 2

DISTRICT 1

DISTRICT 3

Legend

PLANNED OR UNDER CONSTRUCTION

PRODUCTS PIPELINES

- Greatest single network is in District 2. Major movements within the district are from refineries in Oklahoma-Kansas to consuming points in North Central States and Lower Great Lakes Area with daily capacities of 458,000 bbl. and 271,000 bbl., resp.
- Pipelines out of District 2 have a total capacity of 118,000 B/D to Districts 1 and 3, and the International Boundary, while those entering have a total capacity of 478,00 B/D from Districts 1, 3, and 4.
- Primary movement in District 3 is to southern portions of District 1, 250,000 B/D.

Legend

- PROPOSED
- L.P.G.-ETHANE MIX
- L.P.G. SLUGS THRU PRODUCTS LINES
- L.P.G. SLUGS THRU CRUDE LINES
- L.P.G.-NATURAL GAS LIQUIDS MIX
- OWNERSHIP, LINE SIZE, CAPACITY IN BARRELS PER DAY
- DIRECTION OF FLOW
- P.A.D. DISTRICT OUTLINE

DISTRICT 4

DISTRICT 2

DISTRICT 1

DISTRICT 5

DISTRICT 3

HOUSTON AREA

BATON ROUGE AREA

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- Bulk of L.P.G. pipeline distribution is in products pipelines built or converted to handle product with the specific gravity of L.P.G. There are four methods of L.P.G. pipeline transportation:

1. Pipelines batching L.P.G. through products pipelines. 2. Pipelines handling L.P.G. mixed with natural gas liquids. 3. Pipelines handling propane-ethane mixtures. 4. Pipelines batching L.P.G. through crude oil pipelines.

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- **Tank Cars**—96,074 in petroleum service (includes 19,240 L.P.G., 39,432 in chemical service, and 27,553 in misc. service).
- **Tank Trucks**—41,837 over-the-road trucks and trailers, total capacity 242,719,383 gal. (average per unit 5,802 gal.)
- **Barge and Lake Tankers**—2,138 units, 21,932,520 bbl. total (74% of units on Mississippi River System, 19% on East Coast waterways, 6% West Coast waterways and Alaska, 1% on Great Lakes).

Supplement to The Oil and Gas Journal, Vol. 56 No. 10 (1958). Data from "Petroleum Transportation," a report of The National Petroleum Council, 1958.

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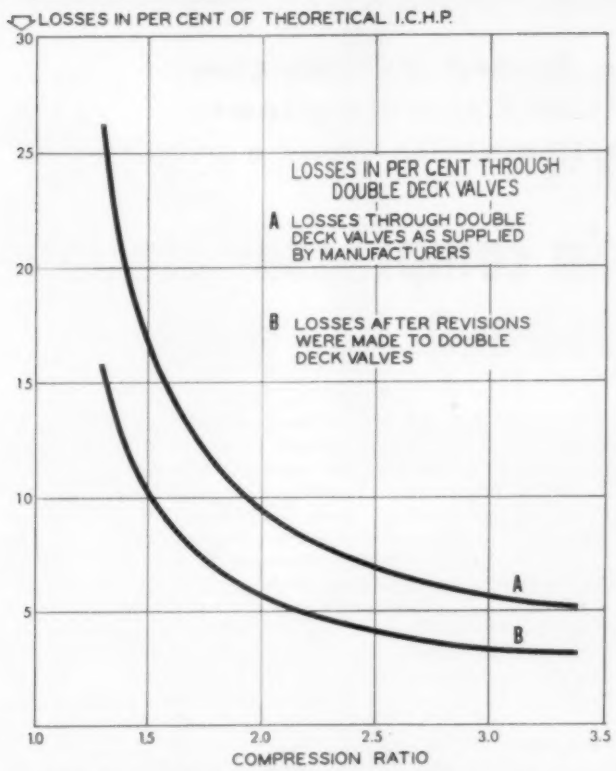
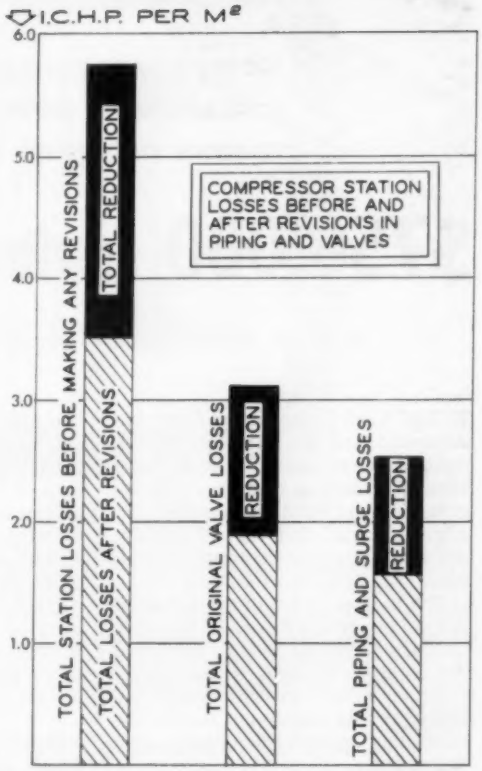


PER CENT OF LOSS is shown before and after revision of valves. Fig. 4.



TOTAL REDUCTION of losses is 2.2 i.c.hp./M.² Fig. 5.

An analysis of test data showed the following reductions of i.c.hp./M.²:

	I.c.hp./M.²
0.032-in. spacer plate installed	0.68
0.032-in. spacer plate plus thinner valve strips	0.91
Thinner strips only installed (no spacer plates)	0.30
Removal of rib from lower suction valve guard	0.10
Removing silencing strips	0.10
Machining yokes	0.20

The total over-all reduction with all modifications installed amounts to 1.31 i.c.hp./M.² Thus the valve losses were reduced from 3.2 to 1.89 i.c.hp./M.² The original and final losses on the Worthington valves almost duplicate the results obtained on the Cooper valves. The curves on Fig. 3 therefore apply to both types of units.

The percentage losses are shown in Fig. 4. The curves cover the initial and final losses through the double-deck valves.

Summary

Both the piping and compressor valve losses in i.c.hp./M.² are shown graphically in Fig. 5. The improvements are very substantial. The total reduction of 2.2 i.c.hp./M.² represents approximately 2,200 i.c.hp. per station on our enlarged system and a reduction of about 12 per cent in the fuel consumption over what it would be with the initial losses.

The Worthington valves are still being tested to determine just how much valve lift can be tolerated without running into valve strip breakage. The final thickness of valve strips that can be used is also still in question. Until there has been sufficient elapsed time in operation the changes in valve lift and strip material will be limited only to test units.

The changes in the Cooper-Bessemer valves will be incorporated in all of the Cooper-Bessemer units as soon as the material is received.

An item which has not been mentioned in this discussion but which is a part of the station-piping problem is the gas cooling coils. When the line capacity is stepped up during the next expansion program, a check will be made of the pressure loss across the coolers. At that time the compression ratio will be low, and very little, if any, gas cooling will be needed. No doubt, at that time, a bypass will be installed around the coolers to reduce the otherwise severe discharge-piping loss.

Conclusions

There are two very definite conclusions to be reached from the results of these tests:

1. Severe pulsations in compressor piping can and do result in horsepower losses of considerable magnitude. It is interesting to compare the curves shown in Fig. 4 with similar curves shown in E. N. Henderson's paper which was presented at the ASME-OGP meeting in Louisville in 1957, data for which were obtained from the Southwest Research analog.

2. The use of low-valve velocity compressor cylinders and of double-deck compressor valves for low-compression pipeline installations should be given careful consideration. In addition, the design and manufacture of compressor valves should be studied for possible improvements. The use of valves which can be operated with a high lift should be given preference in order to obtain the full benefit of the large valve areas.

Acknowledgment

The writer acknowledges the assistance of W. E. Warner and W. J. Severin, whose work on tests and in preparing reports has made it possible to assemble the information contained in this article.

Compressor-engine flywheel shaft energizes jacket-water pumps and d.c. cooling-tower motors as Texas Gas Transmission shows a . . .

$750,000 saving in compressor stations

BY J. B. EATON, superintendent of compressor department, Texas Gas Transmission Corp.

TEXAS GAS Transmission Corp. has developed and put into operation a unitized drive system that has saved about $750,000 on compressor station expansion and building costs since the original installation in 1952. The program has met with outstanding results.

The basic principle of the new drive is a relatively simple use of the compressor's flywheel shaft furnishing the required horsepower and revolutions per minute to drive a d.c. generator for the cooling-fan motors and circulating pumps for the engine jacket water.

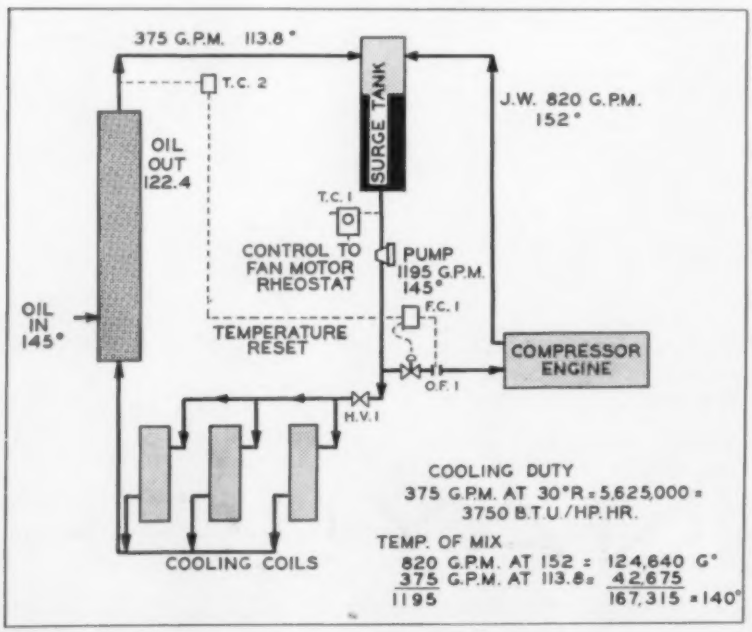
Each compressor engine equipped with the device has become self-sufficient in auxiliary-power requirements. Normally, three to four engines obtain auxiliary power needs from independently housed generators having from 250 to 370 hp. If one or more compressor engines are not running, the auxiliary power unit continues to require almost as much fuel to furnish the auxiliary power for two engines as it does for a full load of three or four. In the unitized-drive method, when the compressor engine is off, the auxiliary-power components are also dormant.

Efficiency comparison . . . Horsepower requirements for the unitized drive are not high enough to interfere with the compressor-engine rated capacity, when compared to fuel-requirement efficiencies of the standard auxiliary equipment in separate plant. For example, in the typical auxiliary-building arrangement, the fuel energy goes from engine to generator to switchgear to pump. Engine efficiency approximates 32 per cent, generator 94 per cent, switch gear 99 per cent, and motor 85 per cent. This results in an over-all fuel efficiency of 25.3 per cent on the drive coupling of the pump.

In the unitized-drive arrangement, fuel energy passes from compressor engine to gear box to pump. Assuming the engine efficiency at 32 per cent, and 98 per cent for the gear box, the calculated fuel efficiency on the drive coupling of the pump is 31.4 per cent.

The Texas Gas electric unitized drive plan contrasts with other systems using hydraulic pumps and hydraulic power units for the coupling between engines and fan. Installation costs and efficiency figures for the hydraulic system will not compare with figures given in this article. In addition, the electric system gives positive and straight forward control and a means of easily and accurately determining the power requirements of the fan at any time.

Another factor in favor of the unitized drive is the short circulatory trip from engine to cooling oil or small individual surge tank. This distance averages about 100 ft. as compared to greater friction losses that unnecessarily occur when the auxiliary or pump building is located some distance from the engines.



SCHEMATIC DIAGRAM of cooling-water flow. Water from engine pours into individual surge tanks at 152° F. and mixes with 114° water from oil cooler. This mix, which is 140° F., splits with 820 going to engine jacket and 375 going to cooling coils and oil cooler. Speed of fan regulates temperature of cooling water.

Unitized-drive savings . . . During 7 years of unitized-drive operations, Texas Gas has maintained performance logs on engine and station efficiency concerning the drive's economy. Fuel consumption is running 6 to 7 per cent lower. Individual fuel meters have been installed on all engines at several stations and all fan motors at each location are equipped

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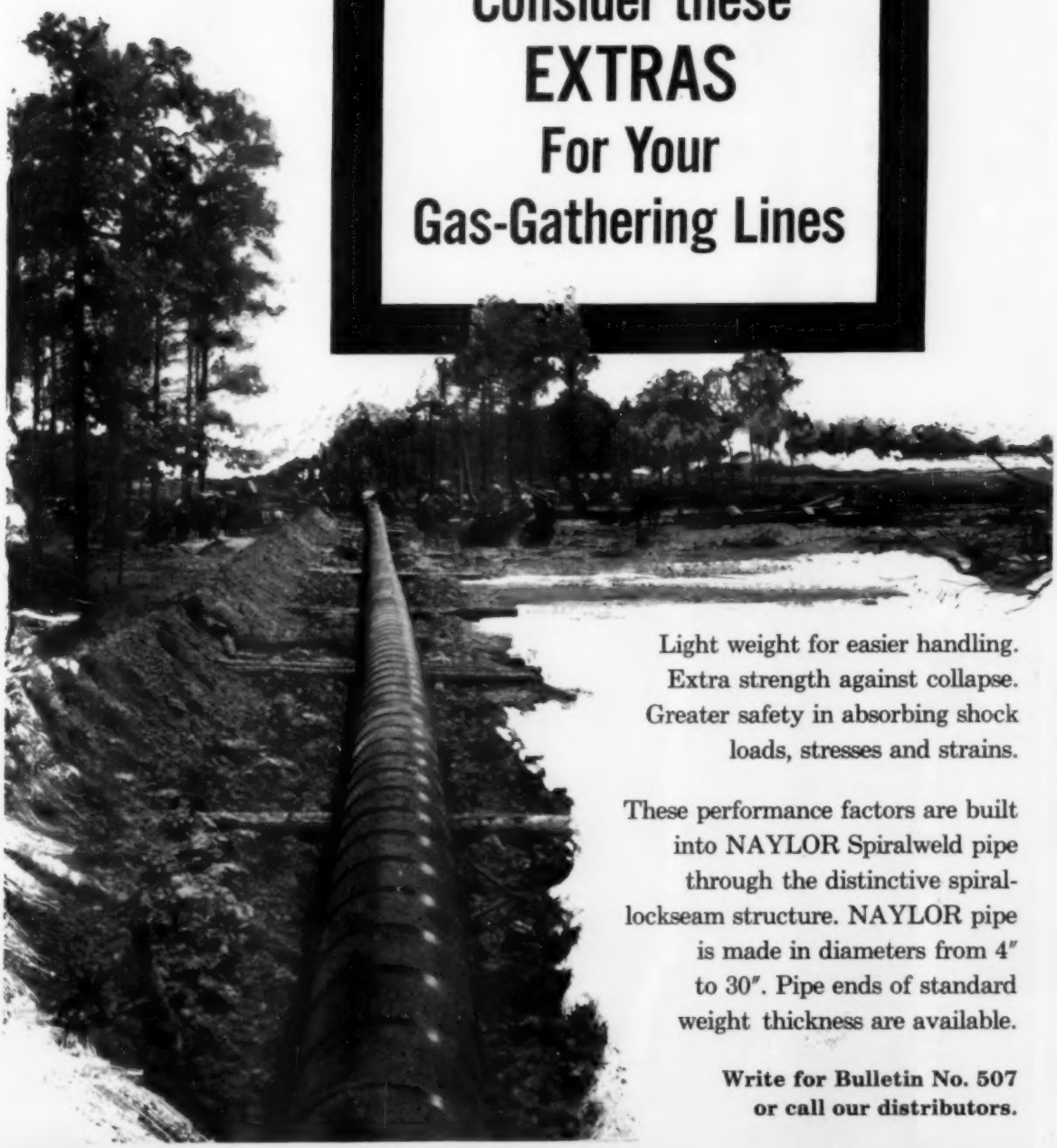

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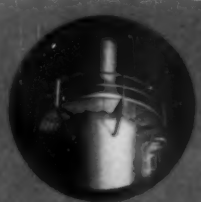

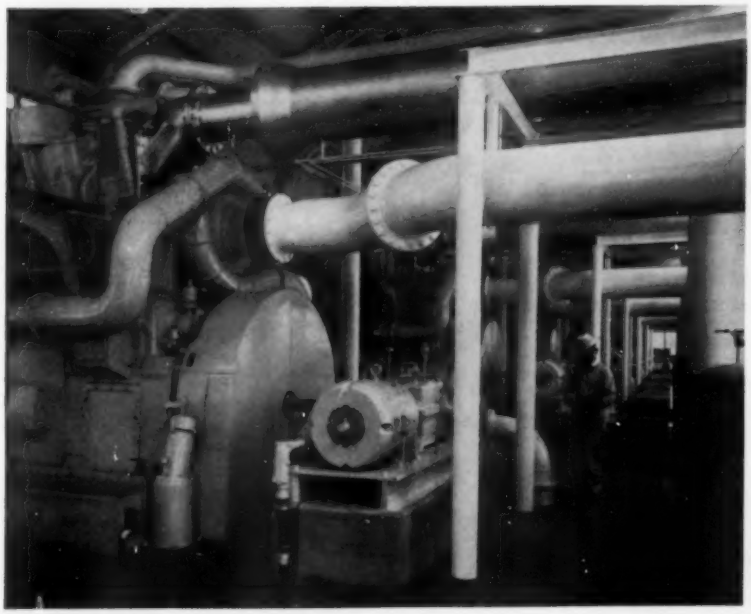

ALL SIX ENGINES at the new Pineville, La., compressor station of Texas Gas Transmission Corp. are equipped with company-developed unitized drives. Note flywheel shaft extension to compound gear box and d.c. generator output lead for operating cooling-fan motor.

with current-demand meters. This permits continual and accurate checking of the input power needs of the d.c. components in the unitized drive.

Since the usual auxiliary building is eliminated there is a 75-kw. transformer rack in a small area to handle power purchased for lighting and miscellaneous uses. A compact 75-kw. standby generator is available in the event of power failure. The expense of purchasing outside power at each location has been low since it is used for little more than lights and the power factor approaches unity.

The unitized-drive development primarily evolved from unexpected price rises during an expansion program coincidentally gaining final approval at the outbreak of the Korean War. Since the original program, 52,250-hp. in unitized-drive engines has been added to facilities at existing stations and new stations. Six of the original stations were already equipped with auxiliary buildings, and in order to keep within the construction budget, unitized drives were coupled to all other installations.

Careful estimation showed that the drives could be installed at approximately $5,000 per engine. By not having to add or build new auxiliary buildings, this developed into an average saving of $150,000 per new compressor station. The compressor department of Texas Gas designed and supervised the installation of the unitized drives at each location.

A total of 57 engines has been successfully equipped with these integral units. Thus, from experimental development to accepted company practice the unitized-drive system has proved economy and dependability of operation beyond all expectations.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained October 1, 1956 (page 110), as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issue of the months of January, April, July, and October.

Index (1946 = 100)

	1949	1952	1954	1955	1956	Nov. 1957
Pumps, compressors, etc.	135.9	155.6	166.5	172.2	192.0	211.5
Electrical machinery	130.9	152.4	160.0	162.5	175.0	191.2
Internal-combustion engines	124.8	146.5	150.5	153.2	164.0	176.8
Instruments	123.1	146.2	154.6	162.9	182.1	193.2
Heat exchangers	133.0	165.8	171.7	156.8	190.7	203.4
Miscellaneous equip. average	*121.6	153.3	160.7	161.5	180.5	195.2
Materials component	143.6	164.3	174.6	176.1	190.4	202.6
Labor component	137.1	163.1	183.3	189.6	198.2	213.2
Nelson construction index	139.7	163.6	179.8	184.2	195.3	208.9

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

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DRILLING

Drilling enlarges North Dakota trend

Operators ponder whether new producing areas will merge into one huge field.

BY NORMAN S. MORRISEY
Drilling-Development Editor

OPERATORS are rapidly enlarging the key Burke County trend, significant new producing area in North Dakota. Uppermost in the minds of all exploration people is the question: Will the Burke County play develop into another Southeast Saskatchewan?

Drilling contractors who were active in the Saskatchewan play recall all too clearly when nearly 100 rigs were busy at the height of the boom. It's too early to predict how big the Burke County play will be but there are similarities between the two areas. In Southeast Saskatchewan, the pay zone is the Mississippian limestone, the same formation that produces in Burke County. In both areas, production is related to stratigraphy rather than to structure. Drilling depths to the Madison at Saskatchewan range from 3,900 to 5,000 ft. In the Lignite area, the Madison is found at drilling depths of 5,800-6,200 ft.

Already several separate fields have been uncovered: Entry, Woburn, Portal, Flaxton, Lignite, and Rival. Although there are dry holes separating some of the producing areas, it is not inconceivable that at least some of these fields will eventually link to form a huge strat trap. Surprisingly enough, a magnetic map of the area (Fig. 1) shows that Flaxton and Lignite are on the same anomaly and could eventually unite. Geologists doubt that the magnetic work is actually mapping structure, but there does appear to be some relationship between the production and the anomalies. Possibly the magnetometer is mapping basement topography which in turn affected the oil accumulation or the lithology.

At the present time, producers in the two fields are separated by an unexplored area 3 miles wide. Development drilling is gradually mushrooming out from the two fields and in time will provide the necessary subsurface control.

Producing zone . . . The reservoir at Lignite and several of the adjacent fields is the Charles limestone or the Midale. It is a porous, locally microgranular limestone. Some geologists consider it correlative with the pay zone at Midale in Saskatchewan. The "Nesson pay zone" at Lignite is a dense crystalline oolitic limestone. Geologists consider that the production at Lignite is largely stratigraphic; the discovery at Ballantine (see Fig. 3) is related to structure.

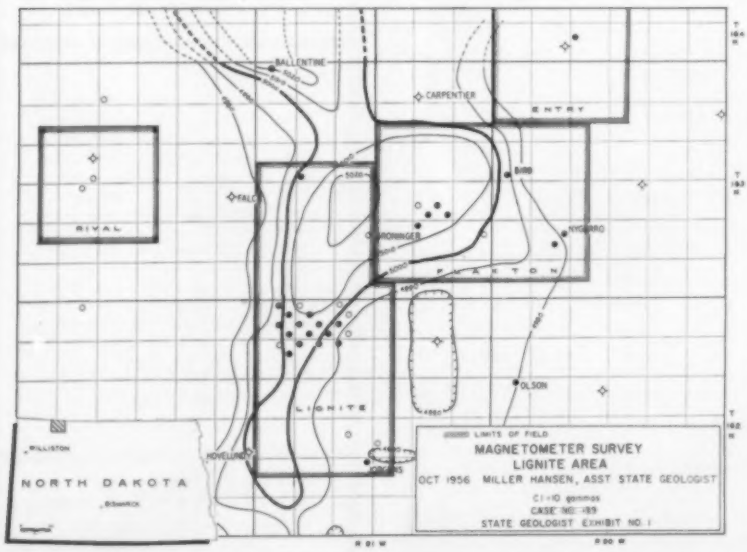
Drilling and completion practices . . . The Lignite area offers few drilling problems. Under normal conditions, contractors can move on location, drill the 6,000-ft. hole, and run pipe in 18 to 20 days. Coring, testing, and completing the well still add 3 to 5 days to the total rig time. As the fields are developed, the present total time of 21-25 days will be reduced substantially. Little time is lost in skidding the rig from one field location to the next.

Normal practice is to set 400-600 ft. of surface casing and then drill a 7⅞ or 8¾-in. hole to total depth. The oil string, usually 5½-in. casing, is run to total depth. Some operators complete the well using the rotary rig after setting the long string.

Some wells flow naturally through perforations, although many are treated with acid prior to completion.

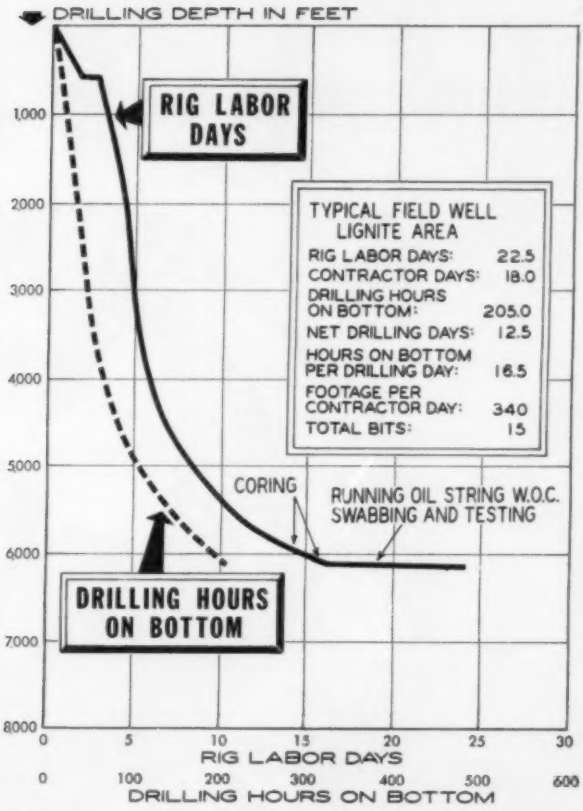
Producing areas . . . At the present time Lignite has 160.1 wells and 5 active locations; there are no dry holes within the limits of the field at press time. Flaxton has seven oil wells and is spread out over an area 4 miles long from west to east and 2 miles wide from north to south. There is still no guarantee that all this area will be productive because of lack of well control. Rival has only two oil wells and one dry hole while Entry has one producer and one duster.

The outlook for Burke County is bright. Any time you find stratigraphic oil, the numerous producing areas can merge gradually into one vast oil field. This phenomenon occurs frequently in oil exploration. Will it happen in North Dakota? It's too early to tell, but it is not impossible. At the moment, a distance of 8 miles separates the most northerly Lignite oil well from the most southerly and the field is 2 miles wide from east to west.

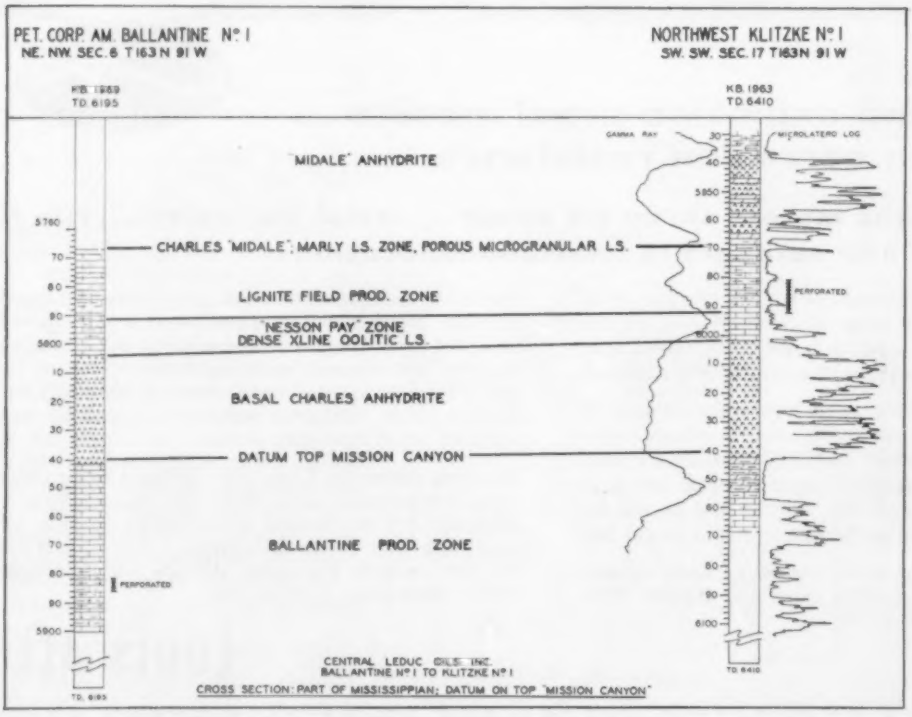


MAGNETIC MAP prepared by the North Dakota Geological Survey shows an interesting anomaly in the Lignite-Flaxton area. Fig. 1.

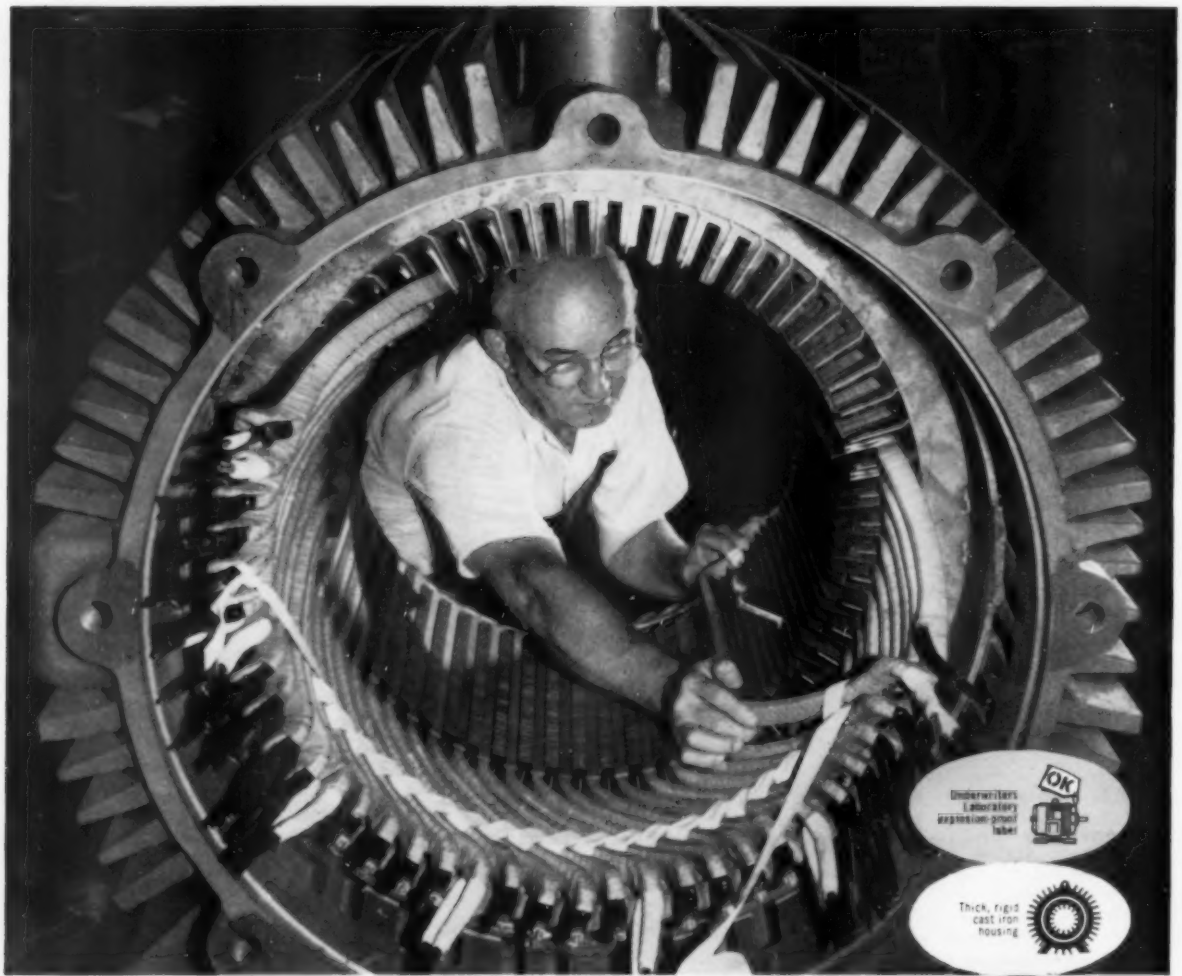
PRODUCTION in the Lignite area occurs at drilling depths of 5,800-6,200 ft. Here Signal Drilling & Exploration, Inc., rig No. 3 is on location in the Lignite field. Fig. 2.



TYPICAL FIELD WELLS require 21-25 days, depending upon the amount of coring and testing required. Contractors normally use 14-16 bits to reach total depth. Fig. 3.



WELL on right is at Lignite and produces from Charles beds or the Midale. The well on the left is a discovery 6 miles north of Lignite and produces from the Mission Canyon or the "Frobisher" beds. (Data presented before the North Dakota Industrial Commission by Central Leduc Oils, Inc.) Fig. 4.



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MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

How to develop a

Refinery-simulation program

for a complete 65,000-bbl. plant, with a medium-size digital computer

BY JOHN S. BONNER,
JOE F. MOORE, and
WILLIAM L. PYLE

WITHIN THIS PROGRAM, solution of three specific problems was tackled: (1) gasoline allocation; (2) cat-reformer charge selection and operation of associated - aromatics fractionation unit, and (3) Bunker C blending.

● The most common method of attacking a problem in refinery economics involves the calculation, in great detail, of a base case. Alternate cases are then worked out and compared with the base case (usually by subtracting all similar items in one case from the other, both barrel-wise and dollar-wise).

● The preparation of these cases is a long and tedious job. Complete material balances must be closed around every unit in the plant. Yield correlations must be evaluated for the various units. Extreme care is necessary in every step of the operation, since the final step will be the subtraction of two sets of large numbers to yield a small difference to which costs will be applied, and upon which a final decision will be based.

● The alternate course of action is to study the plant by a case study technique, using the computer as a tool for generating base and alternate cases. It does this with a speed, accuracy, and thoroughness which cannot be approached in hand calculations.

To perform this case-generated task efficiently, the simulation program:

1. Must be an accurate and complete mathematical and logical model of the plant. The material balances around each unit must reflect capacity limitations, feed-stock quality, and appropriate relations between processing conditions and product mix.

2. Must handle properly the incremental effects, since one of the principal uses of such a program is in the evaluation of incremental changes in operation. A simulation program which processes stocks to fixed dispositions at present yields will fail in this objective.

3. Must not be rigidly tied to the immediate configuration of the refinery. The main purpose of this tool is to serve as an aid in evaluating the effects of change.

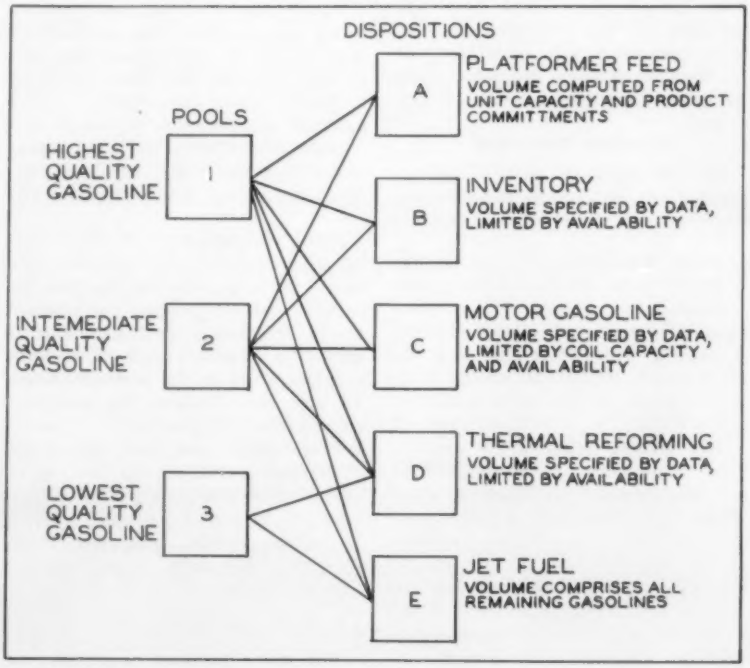
Taken from paper presented at annual meeting of AIChE, Chicago. J. S. Bonner and J. F. Moore are with Bonner & Engineering Associates, Houston. W. L. Pyle is with Eastern States Petroleum & Chemical Corp., Houston.

Development of the Program

A simulation program was set up for a medium-sized (50,000 to 100,000-bbl. per day crude charge) modern refinery, producing a complete slate of fuel products and solvents. The program was prepared for an IBM Type 650 computer, with no auxiliary features other than alphabetic input and output. This computer has an internal memory of 2,000 10-digit numbers. Input and output are through punched cards exclusively, with reading and punching speeds of 200 and 100 cards per minute, respectively.

The first step was a careful and thorough analysis of the requirements of the problem, relative to the abilities and limitations of the computer. A specially designed interpretive programing system was prepared including a short-hand "pseudo code."

Output . . . The result is a final page produced by completely routine card-



STRAIGHTRUN GASOLINE is allocated into five primary fractions. Fig. 1.

handling procedures. A single page is assigned to each unit in the refinery. The columns on the page correspond to the basic streams produced on that unit. The top half of the page is devoted to a listing of the charge stocks to the unit, by rows, with the product breakdown from each charge shown in the appropriate column.

This information is then totaled, both horizontally by charges and vertically by products. The totals line is followed by a section devoted to product dispositions, in which a line is allocated to each product destination. Finally, these dispositions are totaled horizontally and vertically to provide a visual check with the charges.

A rigid rule was established that any number appearing as a charge must also appear somewhere else in the scheme as a disposition, and vice versa, simplifying the job of manually tracing the flow through the set of printed pages.

Crude purchases . . . The refinery in question processes a great variety of crudes every month. Each crude charged to the refinery is defined by approximately a dozen cards. One of these cards specifies the volume and price of the crude in question to be charged to the current scheme. The rest of the cards constitute a permanent library file on that particular crude, and contain information on the physical properties of the crude, transcribed directly from the original crude assay report. These cards are processed by the computer, and the yields and composite inspections of the various streams produced from the crude distillation units are calculated.

Gasoline Allocation

The allocation of gasoline-boiling-range stocks is taken as a typical example of preferential stock allocation.

Gasoline disposition . . . As shown in Fig.1, there are five primary dispositions for material in this boiling range. These include (1) Platformer charge, (2) Platformer charge to inventory, (3) straightrun motor gasoline, (4) thermal cracking-unit charge, and (5) fuel.

The volume required by each of these consumers are determined in several different ways. The Platformer charge is calculated as a function of gasoline quality and must simultaneously satisfy certain solvents requirements as well as limitations on three units. The Platformer charge to inventory and straightrun motor-gasoline volumes are specified as data. The amount to be charged to the thermal coils is also specified as data, but may be subject to capacity limitations on the thermal cracking unit itself. Finally, any gasoline not diverted to one of the preceding four dispositions is rerun for jet fuel.

The amount allocated to each of these dispositions is also limited by the availability of gasoline at the minimum acceptable quality level. Since the information necessary for determination of the Platformer-charge volume cannot be developed until after the crude-distillation phase is complete, it is impossible to allocate the various gasoline stocks as they are distilled. Instead, the problem is handled in the following fashion:

- As each crude is distilled, its gasoline fraction is blended into one of three segregated pools, depending upon its aromatic and naphthene content.
- Highly naphthenic crudes are placed in pool No. 1, and constitute prime Platformer charge.
- Paraffinic crudes are allocated to pool No. 3, and are defined as being suitable only for thermal reforming or jet fuel.
- Intermediate stocks are placed in pool 2.

As the five dispositions previously mentioned appear in sequence in the program, they are filled from these three pools. In each case, the computer will first attempt to fill the requirement from pool 1, moving to pool 2 or 3 if sufficient prime-quality stock is not available.

Fig. 1 illustrates the combinations which are possible. The selection of three pools for segregation was not an arbitrary one, nor was it imposed by limitations of the computer or the program. Instead, this degree of segregation was selected as being representative of the actual degree of segregation practical in the refinery itself.

Varying endpoint . . . A final complicating factor in the gasoline picture is introduced by the fact that the endpoint of the gasoline cut charged to the Platformer prefractionator is varied to conform with a bottoms rate limitation on the prefractionator. To meet this situation, the computer first distills the gasoline to a standard cut point, and then, during the Platformer-prefractionator section of the program, computes a correction factor to adjust the gasoline rate to its proper volume, making a corresponding adjustment in the adjacent kerosine stream.

Platformer-Charge Selection

For every problem of product allocation, there exiscts a parallel one of feed-stock selection. This can be illustrated by considering the way in which the Platformer charge is determined. This program block immediately follows the crude distillation. The Platformer-reactor charge rate is specified as data to the program. The problem then reduces to one of selecting a prefractionator charge rate, prefractionator cut point, and prefractionator charge endpoint which will simultaneously satisfy several solvent requirements, the specified reactor charge rate, and a stream-day bottoms limitation on the prefractionator tower itself.

The Platformer correlations must be evaluated in terms of the aromacity, naphthene content and endpoint of the reactor charge.

The situation is further complicated since the average quality of the prefractionator charge is not known at this point. Instead, the computer has available to it only the volume and analysis of several pools of potential prefractionator charge of successively poorer quality.

The calculation itself is a two-level trial-and-error calculation. In actual practice, the entire operation, including evaluation of Platformer and Platformer - material balances, consumes less than 5 minutes.

Chemical fractionation unit . . . This unit consists of several distillation towers, and is used to rerun various streams produced in the refinery for the production of aromatic and aliphatic solvents and specialties. Within the period covered by any particular scheme, it may be desired to schedule as many as 5 or 10 different operations on this unit.

The computer is provided with a library of all possible operations on the unit. Each operation is represented by a single card, specifying the charge stock to the operation, the dispositions of all of the products, the yield structure, the stream-day charge rate, and an identifying operation number. This library will normally contain 40 or 50 items, and may, in theory, contain several hundred.

The economist fills out a requirements card for each operation he wishes to include in the particular scheme under study. The requirements cards specify the operation number and either the desired volume of charge stock to be processed, or the required volume of any product to that produced from that operation.

The computer loads the requirements cards, and then automatically searches the library to compile a complete file of information on each operation.

The operations are processed in

the same sequence in which the requirement cards were loaded into the computer. The charge rate for each operation is set to meet the charge or product rate requirements specified by the economist, subject to limitations in available charge stock or unit capacity. Provision is made for charging materials to and from inventory, for charging the products of other units, or for recycling the product of one chemical fractionation operation to a later, second pass operation on the same unit.

Bunker C Blending

The third major block of the simulation program includes the light-ends systems and the processing sequence for the kerosines, cat feed stocks, and residual fuels. The Bunker C calculation illustrates several important points. Of particular interest in this section is the way in which downtimes on the various units are handled.

Bypassing . . . When the vacuum unit is shut down for repairs, it is necessary to bypass flash-tower bottoms directly to the thermal cracking unit, since no intermediate storage is provided for this material. To minimize the amount of material bypassed in this way, the refinery is usually scheduled such that crudes producing minimum bottom yields are being run during that period when the vacuum unit is down.

To reflect this operating flexibility, the economist is able to specify the stream-day rate at which topping-unit bottoms are to be bypassed around the vacuum unit during downtimes. This material goes to the thermal cracking system with its properties unaltered from those calculated by the crude-distillation program. The rest of the topping-unit bottoms is processed through the vacuum unit, and the properties of the vacuum-tower bottoms calculated by correlation. Simultaneous downtimes of the topping unit and vacuum unit can be represented by simply specifying a zero bypass rate.

At the same time that the Bunker C base-stock pool is being accumulated, a pool of potential catalytic-cracking-unit charges has also been prepared. The computer selectively picks enough material from this pool to fill the cat unit, bypassing materials to inventory or bringing in purchased cat feed stocks is needed. The cat-cracking correlations are evaluated, and the volume of all catalytically cracked products is calculated. After division of specified amounts of heavy gas oil to No. 2 gas oil and thermal cracking, the slurry and remaining heavy gas-oil streams are used to blend Bunker C fuel to viscosity specifications.

The computer will dip in whatever stocks have been made available to it, either blending all of the Bunker C to final specifications, or yielding any unblended material to inventory. A final recap shows the complete breakdown of the finished Bunker C pool, including gravities and sulfur contents on all stocks and on the finished blend.

The preceding discussion has been limited to only a portion of the processing shown.

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New acid formation cleaner promises

Better fluid recovery on drill-stem test

New technique is said to more accurately evaluate formations during a drill-stem test by reducing hole damage and allowing formations to produce near their maximum production.

BY E. V. LANCASTER, H. E. SCHWEGMAN, and W. H. WRIGHT

IN MANY INSTANCES it is not possible to recover a conclusive amount of fluid during a drill-stem test until the well-bore damage, caused by drilling operations, is removed. A new tool (acid formation cleaner) and a proper selection of chemicals are being used to remove or minimize this hole damage with very good results. The acid formation cleaner is used in conjunction with drill-stem-testing tools to wash and clean the face of the formation prior to taking the test.

Since the tool and acid are run in the hole along with the testing tools, reducing formation damage and taking the test are done with one trip in the hole. Reducing the hole damage and allowing the well to produce near its maximum production decreases the possibility of passing up a zone that may contain oil in commercial quantities or it may prevent the setting of pipe on a well with a high formation pressure and an indication of oil but will have an uncommercial recovery after the formation is cleaned.

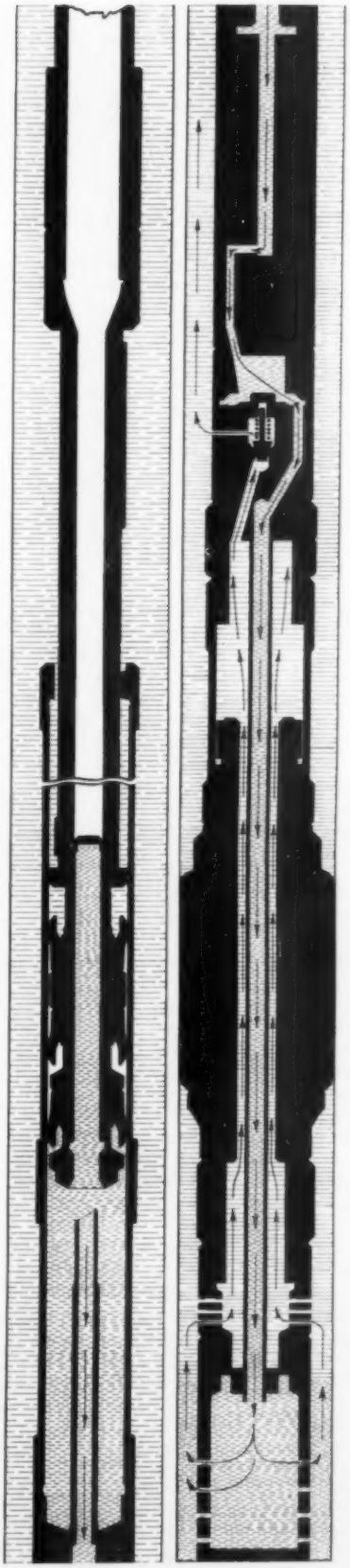
The hole damage caused during drilling operations is apparent as a reduction in permeability immediately surrounding the well bore. This reduction in permeability may be caused by (1) effect of drilling fluids on the formation, (2) effect of cuttings on the formation, (3) effect of formation gas released from formation fluid, and (4) the effect of physical distortion by drilling tools.

In the case of severe formation damage the production during the period of the drill-stem test will be much less than if the well bore was not damaged. The ratio between these recoveries or the ratio between theoretical and actual productivity index at the time of measurement is expressed as "damage ratio." If the damage ratio, for example, was four and the damage was then removed the formation should produce four times as much as was actually recovered on the test.

If a high damage ratio exists and formation pressure is appreciable even though recovery was only a slightly oil-cut mud or clean mud, it may be advisable to run the acid formation cleaner to remove the damage by chemical action and reveal the true formation production. A large recovery of mud may indicate that drilling fluid was lost to the formation. This fluid loss could cause the high damage ratio as thick mud cakes are frequently formed over zones of high permeability.

Tool Description and Operation

The acid formation cleaner consists of a device run directly above the testing tool with a proper solution of acid retained in the device by the closed testing tool on the bottom and a disk valve on top. When the tools reach bottom the packer is seated and the testing tool is opened. The acid is then forced (by lowering the drill pipe) through an arrangement of fluid passages and is placed



PLACING OF ACID is shown in this flow diagram of the acid formation cleaner. Total depth 1,019-25 ft. (Diagrams divided in two for better reproduction.) Fig. 1.

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MUELLER® Curb Valve Tees and DH-2 Drilling Machines make hot taps in high pressure transmission lines a cinch. Lateral connections are made quickly under completely controlled conditions. And a means of shut-off is provided right at the transmission line.

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3. Drill through tee into transmission line with DH-2 Machine as shown at left.
4. Insert valve stem into tee with completion machine.
5. Cap tee and open valve to complete installation.

Specifications . . . . . ▶

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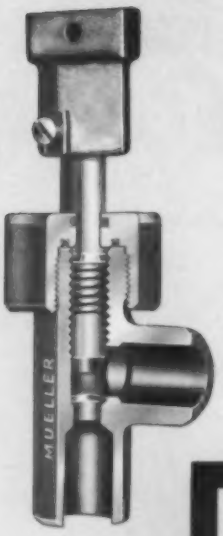

Metal-to-metal seat contact in both closed and opened positions gives tight shut-offs and prevents leakage. "O" ring stem and cap seals give a double seal against leakage. If desired, tee may be operated from ground level through a curb box.

H-17800 CURB VALVE TEE

Welding or threaded inlet
— sizes ¾″ through 2″
Welding, threaded, extended, Dresser or insulating outlet
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extended inlet type
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Welding inlet
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Cone-shaped 1″ welding outlet
— for 1″, 1¼″, 1½″ and 2″ pipe

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- Valve stem may be removed and body seat refaced
- Stem seat may be refaced or a new stem inserted
- Both "O" ring seals may be replaced

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Automatic or manual tool feed
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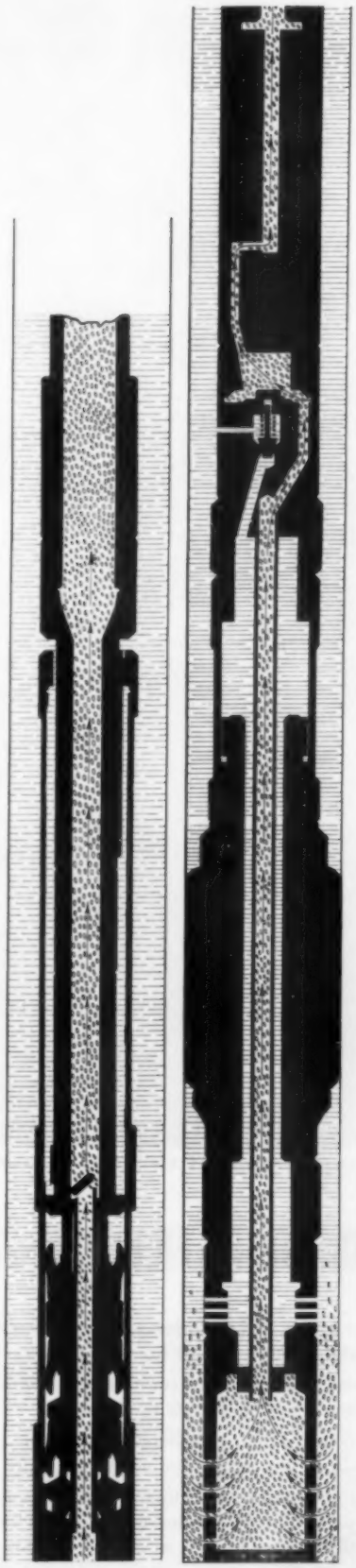


LANCASTER

SCHWEGMAN

WRIGHT

The authors . . .

Verle Lancaster is division testing superintendent for Halliburton Oil Well Cementing Co. at Wichita, supervising drill-stem testing operations throughout Kansas and the Texas Panhandle. After studying at Kansas State College he began driving a pump truck for Halliburton and has since been a cementer, tester, fieldman and district superintendent. He has held his present position since December 1955.

Harry Schwegman is a development engineer in Halliburton's tool-development section. A University of Oklahoma graduate with a B.S. degree in mechanical engineering, he joined Halliburton at its Duncan, Okla., headquarters, concentrating on equipment and tool applications.

Harold Wright is another product of University of Oklahoma and worked for Magnolia Petroleum Co. before joining Halliburton in 1937. Since 1952 he has supervised chemical services for the company's Kansas-Texas Panhandle division, with headquarters at Wichita.

adjacent to the formation (Fig. 1). The mud below the packer is displaced through a bypass arrangement to the annulus above the packer. Chemical action between the acid, the mud, and the formation then takes place. At the conclusion of the chemical reaction the disk valve is broken by a builtin spear in the tool which allows the formation fluid and the spent acid to enter the drill pipe (Fig. 2). All subsequent operations are the same as for a conventional drill-stem test.

The method of cleaning the formation has varied but best results have been obtained by selecting a quantity of acid sufficient to displace the mud below the packer two or three times. The cleaning operation is then done in two or three cycles, each cycle displacing the mud at a 10 to 15-minute interval which allows sufficient time for chemical action to take place.

The chemical agent usually contains HCl and surfactants and is determined at the well site by proper analysis. This selection of chemicals will dissolve the carbonates and shrink water-swollen clays in the mud.

TAKING TEST is shown in this version of the flow diagram. All subsequent operations are the same as for a conventional drill-stem test. Fig. 2.

In addition it will serve as a non-emulsifier and emulsion breaker as well as a dispersant of mud particles and will promote more rapid recovery of the treating solution and liquid blocking material by lowering the surface tension of the water and the acid.

Job Histories

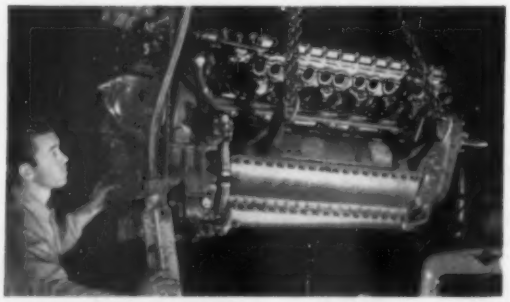
Below are listed several examples of the results obtained using the acid formation cleaner.

Well 1 . . . On the first conventional test, 70 ft. of heavy oil-cut mud and 20 ft. of gas were recovered with a final closed-in pressure of 697 psi. The acid formation cleaner was run on a repeat test and the recovery was 244 ft. of clean oil and 200 ft. of mud-cut oil with a final closed-in pressure of 898 psi.

Well 2 . . . This well was drilled and plugged 15 years ago but was retested with the acid formation cleaner because the original test showed a substantial bottom-hole pressure although there was no recovery. Recovery using the acid formation cleaner was 135 ft. of oil and acid-cut mud. The well is now producing 40 bbl. per day.

Well 3 . . . A series of straddle tests were run on this well in different zones with the acid formation cleaner. The recovery on each test was a consider-

DOWELL RECENTLY PERFORMED THIS RECORD-BREAKING HIGH-INJECTION-RATE TREATMENT AVERAGING



IN ALL AREAS now, powerful, remote-controlled Allison-powered pumpers are available to make high-injection-rate fracturing economical. This mighty aircraft engine, heart of the pumping unit, has a maximum rating of 1500 horsepower and delivers 600 hydraulic horsepower from Dowell's high volume pumps.

HIGH-INJECTION-RATE FRACTURING BY

Many operators are going to high-injection-rate fracturing for one simple reason. It gives them more oil for their money!

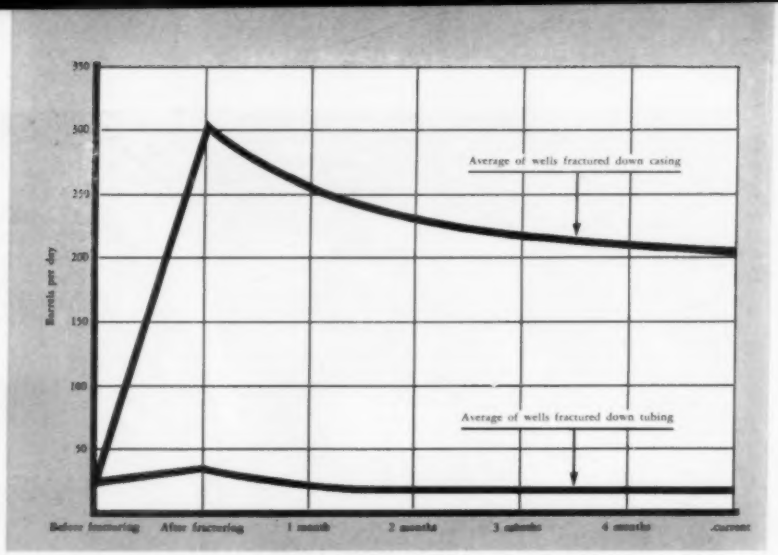
At first this may seem strange. More equipment is required for the treatment. The tubing string may have to be pulled.

When all factors are taken into consideration, the cost per job is considerably higher—but the results are often startlingly better.

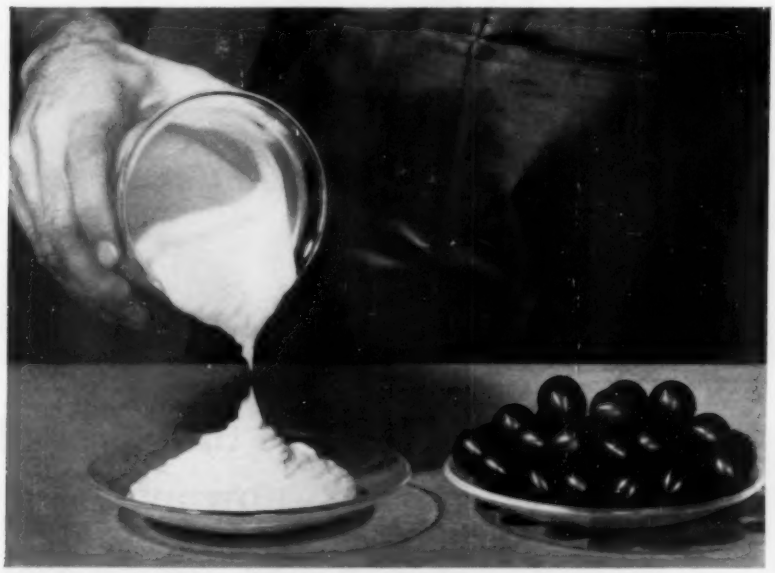
Many wells that do not respond well to fracturing down tubing show excellent results when tubing is pulled and injection rates are increased. The graph on the next page is an example of this fact as proved in one producing field.

To help make high-injection-rate fracturing practical, Dowell

71 BBLS./MIN. WITH 6250 HHP.



IN YOAKUM COUNTY, WEST TEXAS, a study was made by oil company engineers, comparing the results of high-injection-rate fracturing down casing with low-injection-rate fracturing down tubing. This study showed that casing jobs yielded far better results. The average initial increase was over 12 times as great. More important, however, production held up far better as shown on the graph.



NEAR SHREVEPORT, LOUISIANA, as well as other areas, some operators use Fixafrac® or ball sealers to improve the effects of high-injection-rate fracturing. Temporary plugging materials help spread the force of the treatment over the entire face of the pay for better results.

DOWELL-FOR GOOD ULTIMATE RECOVERY

developed the remote-controlled pumper powered by an Allison aircraft engine. This is still the most powerful unit—pound for pound—in general use.

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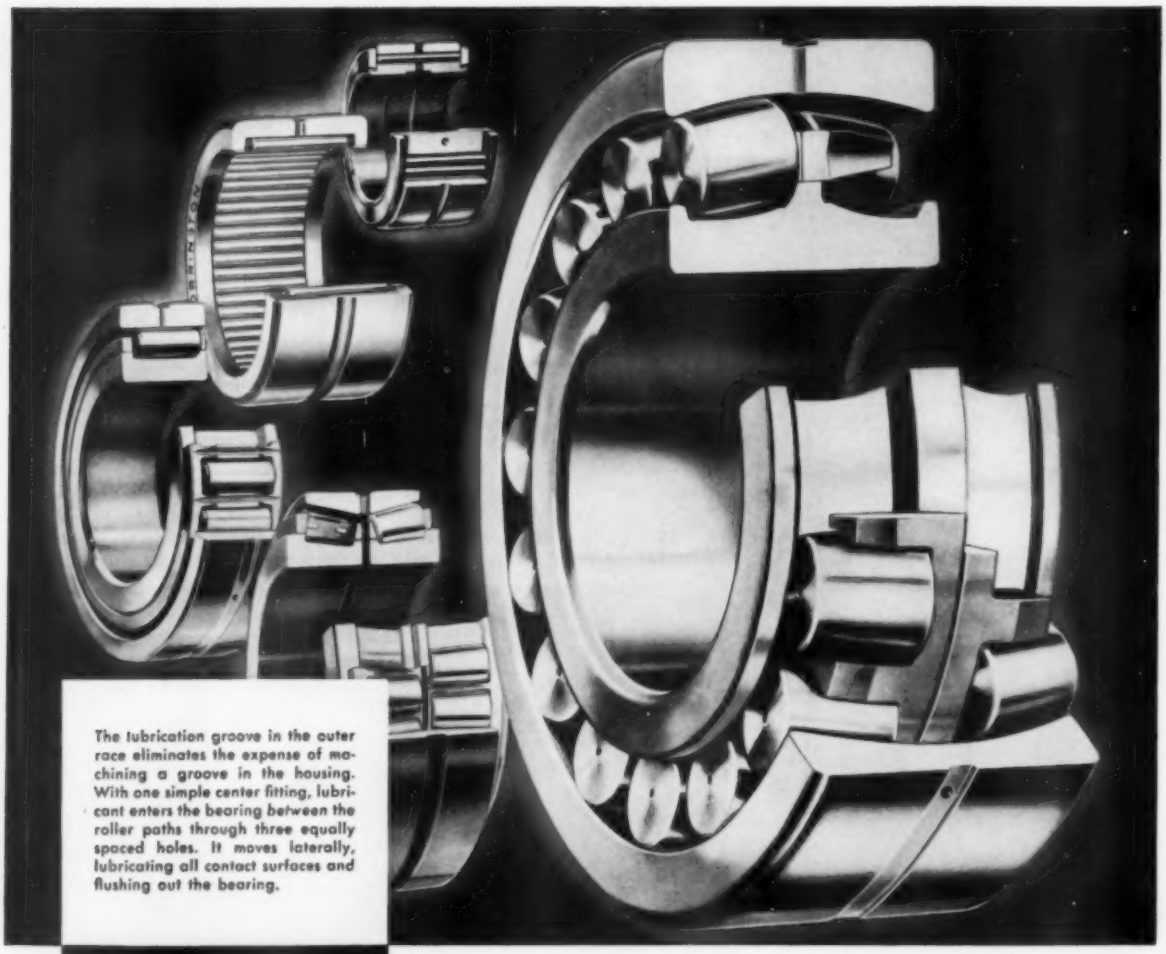
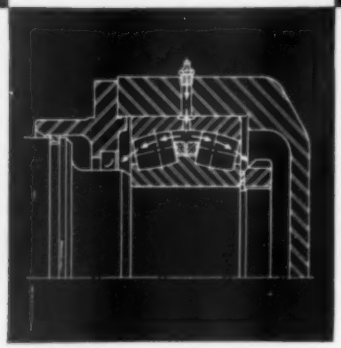
PULLING TUBING can be one of the greatest aids to high-injection-rate fracturing. Many operators have found that the cost of pulling tubing amounts to only a small per cent of the total cost of fracturing. Yet, the production increase sometimes is more than twice as great.



The lubrication groove in the outer race eliminates the expense of machining a groove in the housing. With one simple center fitting, lubricant enters the bearing *between* the roller paths through three equally spaced holes. It moves laterally, lubricating all contact surfaces and flushing out the bearing.



A time-proved lubricating method now available on Torrington Spherical Roller Bearings

The circumferential groove in the outer race has met the test of experience in many Torrington Bearings, including Heavy Duty Needle Bearings, Aircraft Type Needle Bearings, Tapered and Radial Roller Bearings. Now the circumferential lubrication groove is available in Torrington Spherical Roller Bearings.

This design feature makes it possible to introduce lubricant *between* the roller paths without the expense of machining a groove in the housing. This groove is proportioned to provide generous lubricant flow capacity. Lubricant moves through the roller paths, flushing used lubricant and contaminants away from bearing contact surfaces.

Torrington Spherical Roller Bearings in many sizes may be ordered with this groove as desired at no additional cost. For further information, see your Torrington representative or write: **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

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able amount of salt water. Setting of pipe on this well was prevented. The log on this well indicated good porosity and low water saturation.

Well 4 . . . A conventional test was not run on the particular zone in this well, but nearby wells in the same zone and structure did not recover the kind of fillup described below using the acid formation cleaner. Recovery using the cleaner was 200 ft. of gas, 30 ft. of mud-cut oil, 30 ft. of oil-cut mud, 150 ft. of oil-cut water, and 840 ft. of water. A string of pipe was probably saved by running this test.

Well-Site Method of Determining and Removing Hole Damage

A series of nomographs have been published that make possible a quick and easy method of determining approximate hole damage or skin effect at the well site. The requirements of this method are that a test taking dual closed-in pressure be run and that the initial closed-in pressure has reached static conditions. The assumption is then made that the initial closed-in pressure is equal to the original reservoir pressure. The damage ratio can then be calculated by the following formula:

$$D.R. = 0.183 \times \frac{ICIP-FFP}{ICIP-FCIP} \times \text{Log } 10 \frac{T+0}{\theta}$$

Where:

D.R. = damage ratio
0.183 = constant
ICIP = initial closed-in pressure
FFP = final flow pressure
FCIP = final closed-in pressure
T = time tool open
θ = time of final closed-in pressure

It is obvious that accurate time and pressure measurements are needed throughout the drill-stem test as the pressure-buildup curves in conjunction with flowing pressures are used to determine the amount of damage.

If a conventional drill-stem test is run taking double closed-in pressure and the damage factor as calculated at the well site is high, then it may be very advantageous to use the acid formation cleaner on a repeat test to determine the actual productivity index of the well. The information received in a short time and at relatively small expense may be invaluable in determining the subsequent well-completion procedures.

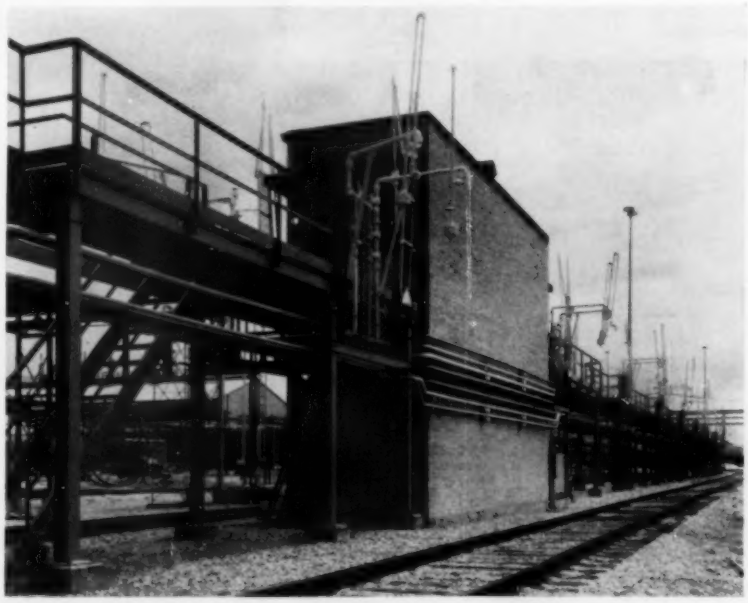
Of course, if data exist from a conventional drill-stem test where only the final closed-in pressure was taken and that pressure had been allowed to approach its maximum the damage ratio can be calculated from existing formulas although the procedure is somewhat longer than necessary when using the nomograph method.

In many cases, however, an actual measurement of hole damage is not determined but there is a great possibility that it does exist based upon previous information and experience obtained from other sources. In these cases the acid formation cleaner is run on the initial test to obtain the maximum production.

Still in other cases, old wells that were tested previously with little or no production have been retested with the acid formation cleaner and a commercial producer has been obtained.

New rack speeds LPG traffic

LPG TRAFFIC in and out of refineries is growing. At Esso's Baton Rouge refinery, largest in the nation, the swelling volume of outgoing propane and incoming butane and isobutane outgrew this old loading rack.



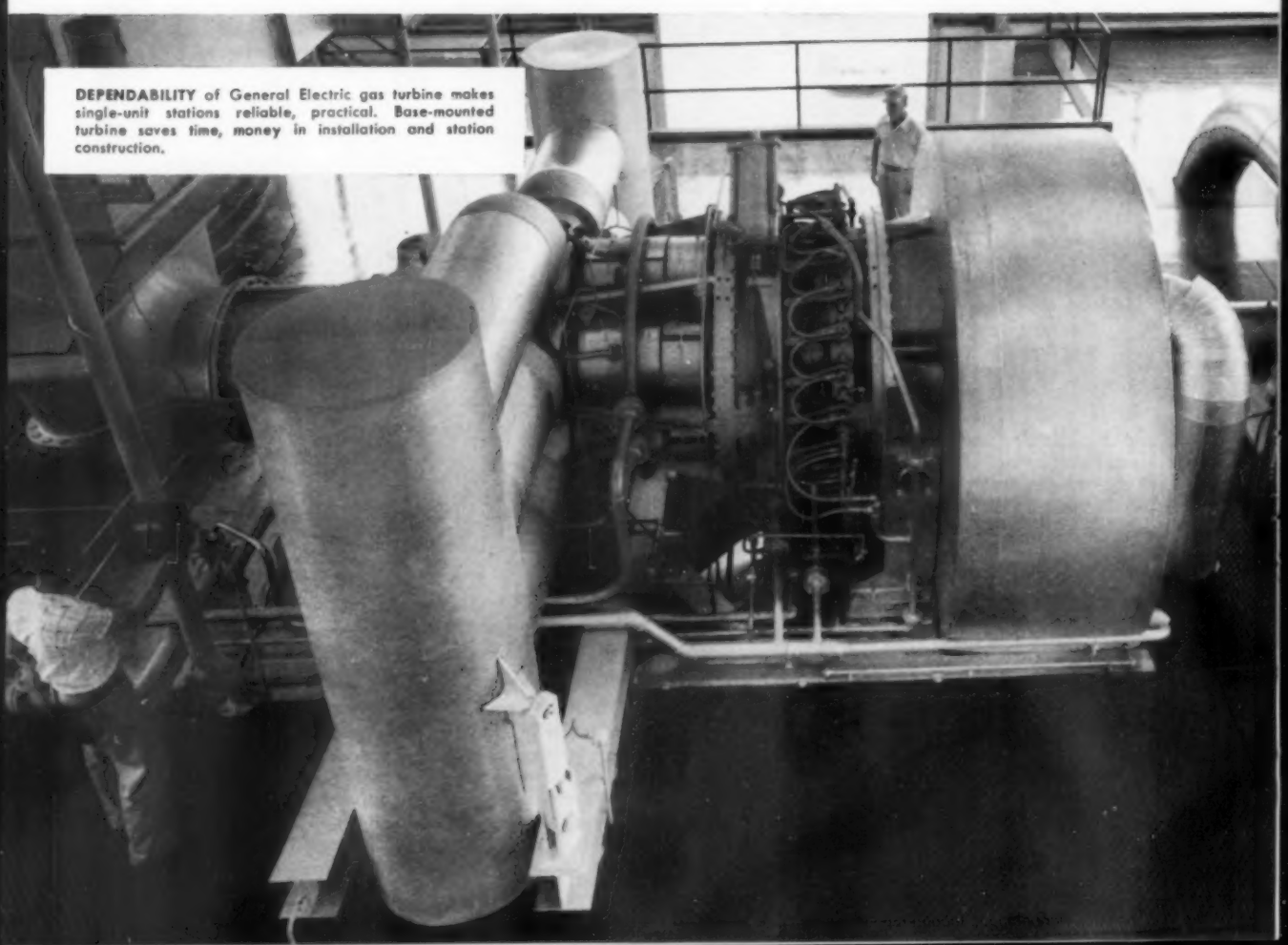
THE RESULT, new LPG facilities which will handle 42 tank cars at individual loading bays. The new terminal boasts a control room which houses instruments for the loading rack and the refinery's propane-storage facilities, and the controls for the propane-loading pumps.

Esso uses large volumes of isobutane and normal butane for alkylation, motor-fuel blending, and petrochemical manufacture.

CENTRALIZED CONTROL in convenient, easily accessible location affords one operator automatic operation of the drive system.

AT TENNESSEE GAS TRANSMISSION COMPANY . . .

New Compressor Station



DEPENDABILITY of General Electric gas turbine makes single-unit stations reliable, practical. Base-mounted turbine saves time, money in installation and station construction.

SAVINGS on installation, maintenance, and operating costs were the result of close co-operation between Tennessee Gas Transmission Company personnel and General Electric engineering services.

FACTORY ASSEMBLED General Electric Cabinetrol* panels afford centralized control of all station auxiliary equipment. Compact design requires minimum of station's valuable floor space.

Starts Up in Record Time

GENERAL ELECTRIC'S COMPLETE ENGINEERING SERVICES ORGANIZATION WORKING CLOSELY WITH TGT ENGINEERS FACILITATED INSTALLATION AND "START-UP" OF A G-E GAS TURBINE AT TGT'S SAVANNAH STATION IN RECORD 27 DAYS

Twenty-seven days after unloading its General Electric gas turbine, Tennessee Gas Transmission Company's new Savannah, Tenn. station was in operation. This record installation time was made possible through close co-operation between TGT engineers and General Electric's complete engineering services organization.

FROM DESIGN STAGES through application engineering, manufacture, installation, and operation, General Electric's wide experience in this field was utilized by TGT. The result was a drive system that exactly meets the particular station requirements of TGT.

DEPENDABILITY of all General Electric station and auxiliary equipment means a big dollar savings in terms of costly space, stand-by units, and emergency downtime.

TO HELP SOLVE YOUR STATION DRIVE REQUIREMENTS, General Electric makes available to you these complete engineering services. As with the Tennessee Gas Transmission Company installation, G-E engineers will co-operate closely with you in helping to design and install the drive system that exactly meets your station requirements. Get complete information from your nearest General Electric Apparatus Sales Office and meanwhile write for Bulletin GEA-6401, Combustion Gas Turbines, to General Electric Company, Section 661-56, Schenectady, N.Y. *Reg. trade-mark of General Electric.

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Advanced-design fluid catalytic cracking unit under construction by Foster Wheeler at Baytown, Texas. Structure supporting high crane will be a permanent elevator tower for servicing the cracking unit.

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BY W. L. NELSON, Technical Editor

Heating values of refinery fuels

PROCESS Costimating installment No. 4 of March 17, 1958, will indicate that 600,000 to 700,000 B.t.u. have been required in the U.S.A. to process a barrel of crude oil, and that the major refinery fuels in the order of importance are (1) refinery gas, (2) natural gas, (3) residual fuel oil, (4) coke (mainly on catalyst), (5) coal, and (6) acid sludge. The heating values of these fuels are indicated in Tables 1-4.

In the Midwest, Texas, and Gulf Coast areas, natural gas with a heating value of 1,100-1,300 B.t.u. per cu. ft. is widely used. Refinery gas is used in all plants and it sometimes constitutes more than half of the fuel required (average is 43.0 per cent). Prices of natural gas will be shown in Process Costimating No. 4 (March 17, 1958), but refinery gas is usually valued at its "fuel-oil-equivalent," based on gross heating values. Coal is used to a minor extent in Pennsylvania and Ohio. Acid sludge is burned more as a method of disposing of it than for its value as a fuel. Thus, little direct profit results from the burning of waste acid sludge because the cost of preparing it for firing is almost as great as its fuel value.

In general, about 60 per cent of refinery fuel can be priced as residual fuel oil by using equivalent heating values (so-called FOE or fuel-oil equivalent).

TABLE 2—GROSS HEATING VALUES OF AVERAGE RESIDUAL FUELS—MILLION B.T.U. PER BARREL*

°API	No sulfur	Cracked 1% S	2% S	3% S	4% S	5% S	6% S	Average
5	6.58	6.52	6.47	6.42	6.36	6.31	6.26	6.42
6	6.52	6.47	6.42	6.36	6.30	6.25	6.20	6.36
7	6.45	6.41	6.36	6.30	6.25	6.21	6.13	6.30
8	6.48	6.43	6.38	6.32	6.27	6.22	6.16	6.32
9	6.51	6.45	6.40	6.35	6.29	6.24	6.19	6.35
10	6.47	6.42	6.37	6.32	6.26	6.21	6.16	6.32
11	6.43	6.39	6.34	6.28	6.23	6.18	6.13	6.28
12	6.43	6.39	6.34	6.29	6.24	6.20	6.14	6.29
13	6.49	6.44	6.38	6.33	6.28	6.23	....	6.36
14	6.54	6.49	6.43	6.38	6.33	6.27	....	6.41
Average	6.49	6.43	6.39	6.34	6.28	6.23	6.17	6.34

*The Oil and Gas Journal, Sept. 20, 1954, p. 299.

TABLE 1—TYPICAL FUEL OILS FROM VARIOUS SOURCES*

No.	°API	Kind of fuel—	Characterization factor	Per cent sulfur	Gross B.t.u. per lb.	Gross B.t.u. per gal.	Lb. per bbl.	Gross B.t.u. per bbl.†	Main use
A	5	Highly cracked naphthene base (as Calif.)	10.2	4.8	17,500	151,000	362	6,330,000	Industrial
B	7	Cracked mixed base (as medium Vene.)	10.4	2.7	17,950	152,300	357	6,400,000	Industrial
C	9	Cracked mixed base (as Ill., Mid-Cont., etc.)	10.6	0.85	18,350	153,500	352	6,450,000	Industrial
D	12	Mildly viscosity broken (as Caribbean)	10.8	2.95	18,200	149,000	345	6,260,000	Bunkering
E	14	Straightrun products (as Caribbean)	11.45	2.2	18,900	153,000	340	6,430,000	Bunkering

*The Oil and Gas Journal, Sept. 20, 1954, p. 299. †Corrected for characterization factor (percentage of carbon and hydrogen) and for percentage of sulfur as well as minor amounts of nitrogen, oxygen, and 1.5 per cent b.s. and w.

TABLE 3—HEATING VALUES OF REFINERY GASEOUS FUELS*

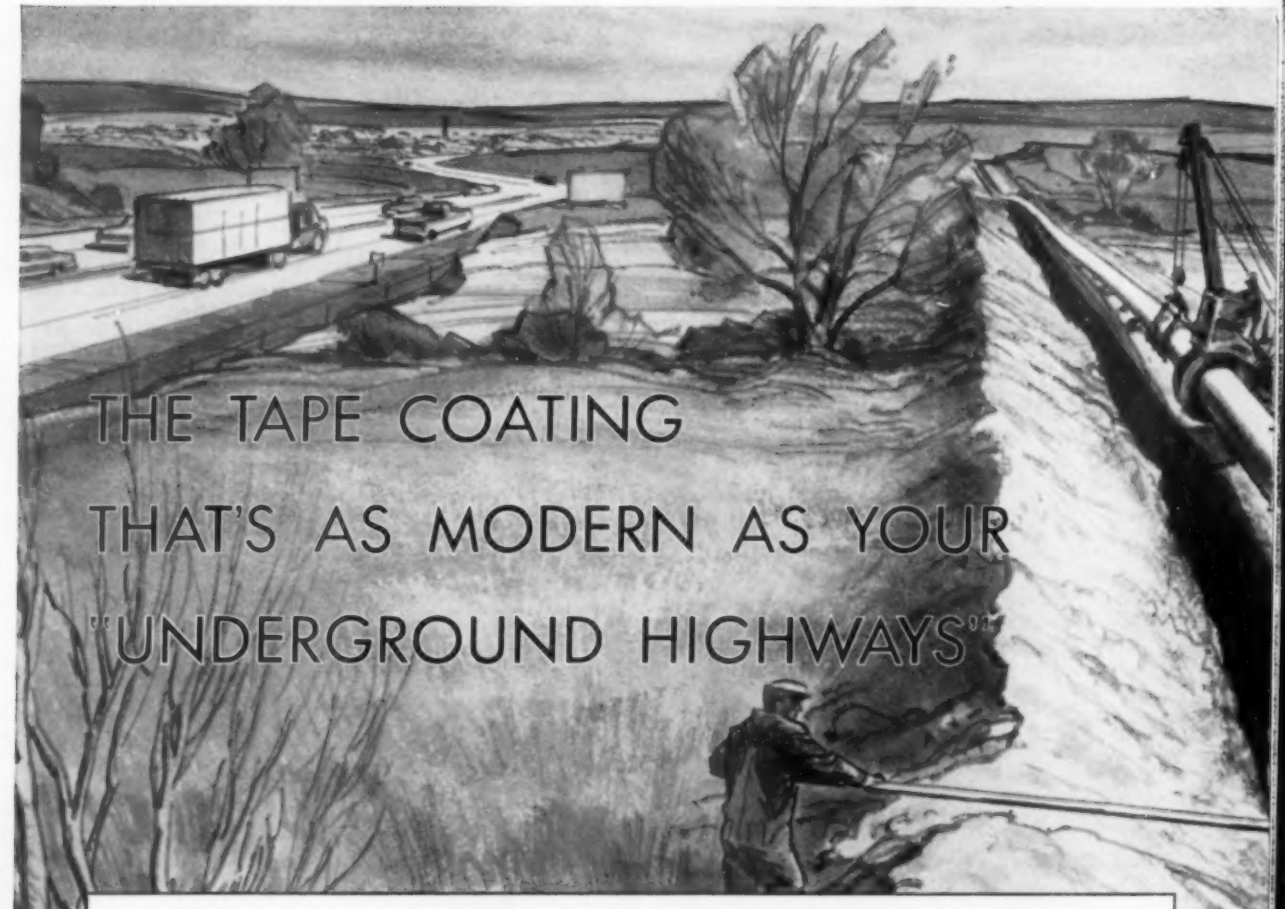
	H_2	CH_4	C_2H_4 and C_2H_6	C_3H_6 and C_3H_8	iC_4H_8 plus	B.t.u. per cu. ft.† Gross	Net	Mol. wt.†	B.t.u. per lb., gross§
Natural gas	...	92	6	1	1	1,080	975	17.7	23,700
Natural gas	..	90	6	2	2	1,115	1,010	18.5	23,400
Natural gas	...	83	7	8	2	1,210	1,105	20.2	23,200
Natural gas	...	71	14	11	4	1,350	1,240	22.8	22,800
Catalytic cracked gas‡	12	19	24	45	(‡)	1,700	1,540	29.6	22,100
Catalytic reforming‡	85	5	4	6	(‡)	535	475	6.6	33,100
Refinery mixtures‡	7	38	29	26	(‡)	1,505	1,390	25.8	22,400
Refinery mixtures‡	18	36	18	28	(‡)	1,385	1,280	23.4	22,800
Refinery mixtures‡	24	48	12	16	(‡)	1,135	1,040	18.7	23,600
Refinery mixtures‡	39	21	23	17	(‡)	1,120	1,030	18.3	23,800

*Gross H.V. = approx. 380 ÷ 46 mol. wt. †Reduced by 1.5 per cent for inert gas. ‡After removal of four-carbon atom gases and one-third of the propane and propylene. §Per pound of combustible (as if no inerts are present).

TABLE 4—HEATING VALUE OF SOLID REFINERY FUELS

Fuel—	°API	H_2O	Ultimate analysis, wt. per cent C	H_2	S	Undetermined ash, etc.	Heating value, B.t.u. per lb. Gross	Net
Bituminous coal, Pennsylvania	....	2.5	77.8	4.8	1.2	13.7	14,000	13,540
Bituminous coal, Missouri	....	2.6	72.6	4.6	1.8	17.4	13,530	13,100
Petroleum coke	....	1.2	96.0	2.1	0.4	0.3	15,241	15,040
Petroleum coke (fluid)	....	2.0	88.6	1.8	6.4	....	14,000	13,930
Petroleum coke (fluid)	....	3.8	89.1	2.1	6.1	....	14,000	13,970
Coke on catalyst	....	....	89-94	5-10	....	....	12,000-14,000†	.....
Acid sludge	....	(20 per cent weak acid)				....	10,200	9,700
Acid sludge	....	(40 per cent weak acid)				....	7,400	7,000
Acid sludge	....	17.5	63.5	8.1	3.2	7.7	*14,341	.....
Kuwait pitch	5.0	....	83.9	10.4	5.4	0.3	17,500	16,600
Cracked pitch	3.3	....	90.6	8.5	0.4	0.5	17,837	17,030

*Dry basis. †As burned in a cracking plant regenerator to some carbon monoxide.



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Reprints of Ralph Ballantine's picture, "Underground Highway," without advertising suitable for framing available at $1 from Polyken.
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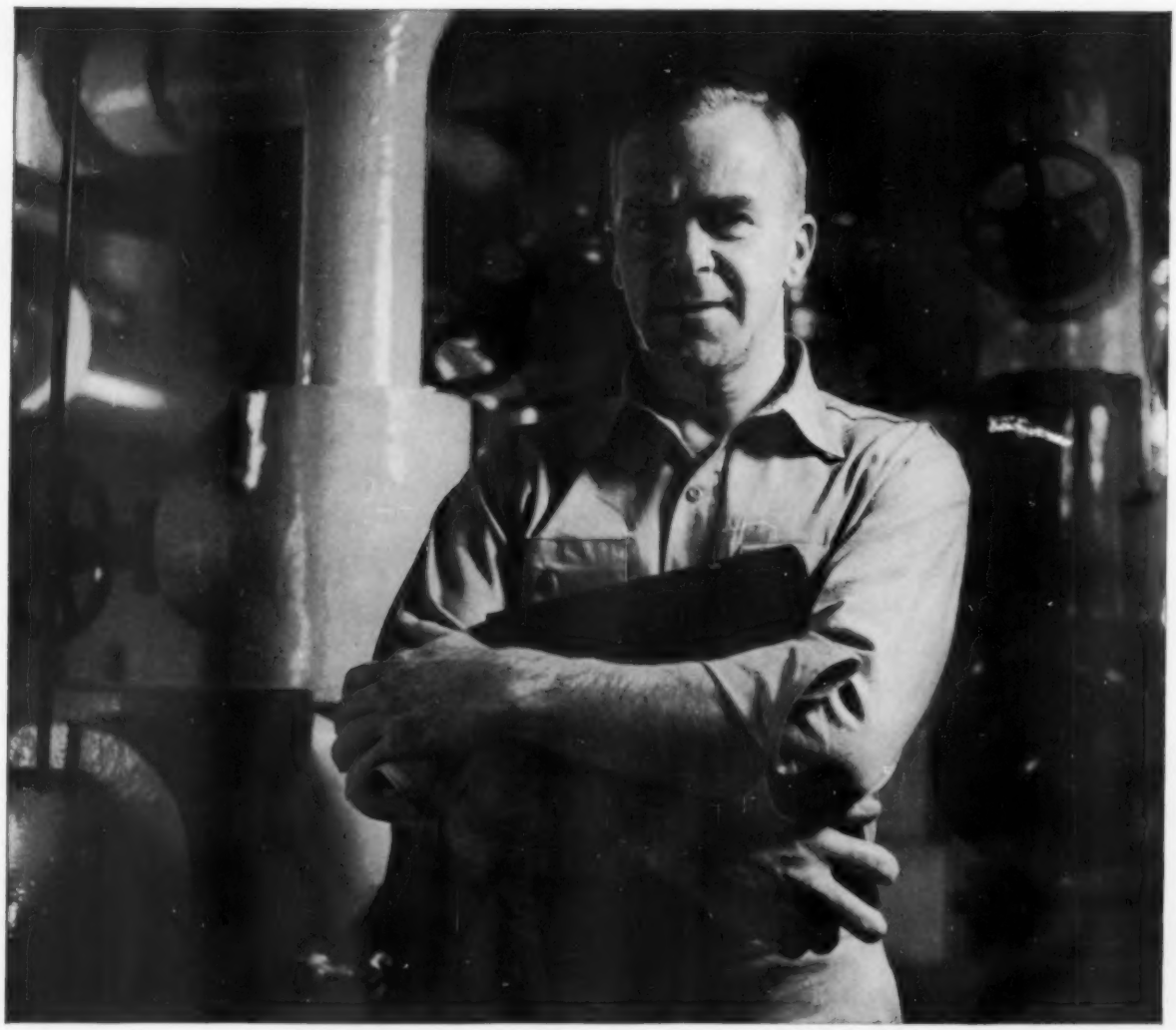

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YOU CAN DEPEND ON DOW

Two zeroing methods can be used for permanently installed volumetric prover tanks

BY M. L. BARRETT, JR.

FIG. 1 shows two different types of zeroing methods for these tanks; on the left is the bottom-valve drain-to-zero type and at the bottom right the zero is marked on the gage-glass scale of the bottom seraphin-type neck.

As illustrated in Fig. 2 practically all such tanks have the graduated-top seraphin neck. The user may deliver into the tops of these types of tanks without vaporization control where the liquid is relatively nonvolatile or where the vaporization which occurs during a meterproof is intended to simulate the vaporization of the normal meter deliveries.

Where good vaporization control is desired with motor gasolines and other volatiles, it is advisable to equip the top of the tank with a spray of the test liquid and to saturate the atmosphere drawn into the tank with each emptying.

This is necessary in the case of pipeline meter proving or where deliveries of a meter are made into a closed receiving system and the meter is not expected to take any evaporation losses.

The problem of proving meters at rates of flow as great as 10,000 bbl. per hour has risen in the last year. The provers thus far described are inadequate for such rates. Fig. 3 shows a single-weir open prover designed by a pipeline company for high-capacity service.

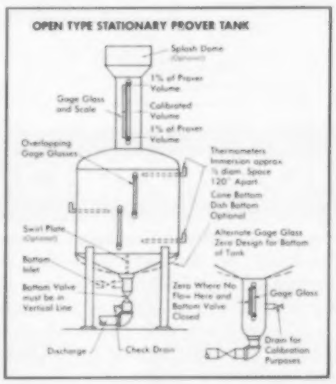
The volume of the prover may be as large as desired. Those that have been built are around 500 bbl. or so. A knife-edge slot or weir near the bottom of the main body of the tank is used as an overflow to establish the bottom zero level of the prover.

The top neck has a reduced cross-sectional area equipped with a gage glass and scale. The lower zero or starting level is obtained by draining the tank through the discharge valve until the liquid level is slightly above the zero line, then drawing the remaining liquid out through the weir-box drain until flow stops.

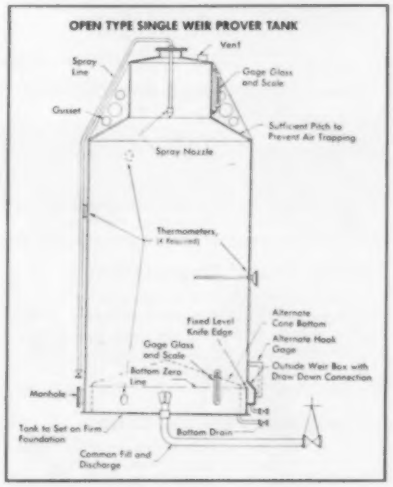
It has been reported that this type prover is slow to come to zero level and the alternate cone-shaped bottom is recommended to speed up this operation. The tank may be equipped with a test-liquid spray at the top for vaporization control. In use, meter proofs are made as has been described for the smaller open-type provers.

A variation of the single-weir-type tank is the large double-weir-type open prover of Fig. 4. Its bottom is essentially the same design as the single-weir tank, but the top is equipped

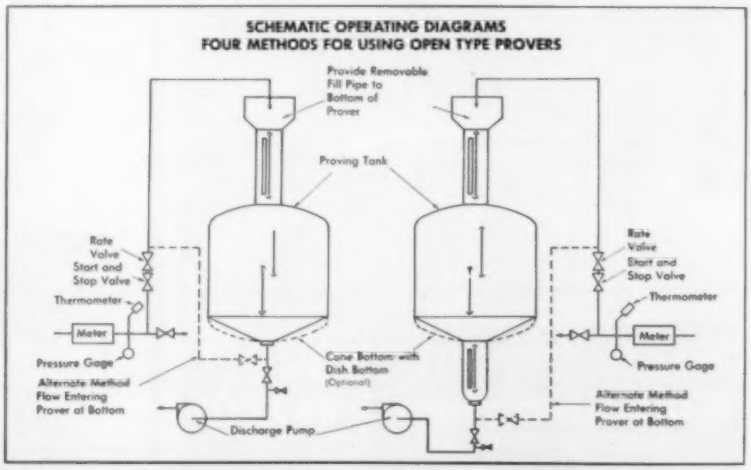
Author is with Shell Oil Co. Paper presented at ASME petroleum division annual conference, Tulsa.


OPEN TYPE STATIONARY PROVER TANK
Splash Dome (Optional)
1% of Prover Volume
Gage Glass and Scale
Calibrated Volume
1% of Prover Volume
Overlapping Gage Glasses
Thermometers Immersion approx. ½ diam. Space 120° Apart
Cone Bottom Dish Bottom Optional
Swirl Plate (Optional)
Alternate Gage Glass Zero Design for Bottom of Tank
Bottom Inlet
Bottom Valve must be in Vertical Line
Zero Where No Flow Here and Bottom Valve Closed
Gage Glass
Discharge
Check Drain
Drain for Calibration Purposes

TWO METHODS of zeroing volumetric prover tanks are shown above. The main drawing illustrates the bottom-valve drain-to-zero type and the inset at right indicates the bottom seraphin-type neck. Fig. 1.



THIS PROVER was designed for high-capacity service. Fig. 3.



OPEN TYPE PROVERS usually have graduated top seraphin neck. Fig. 2.

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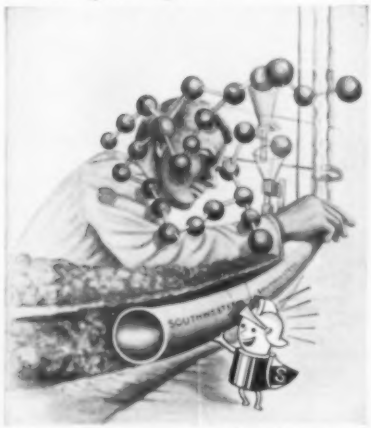

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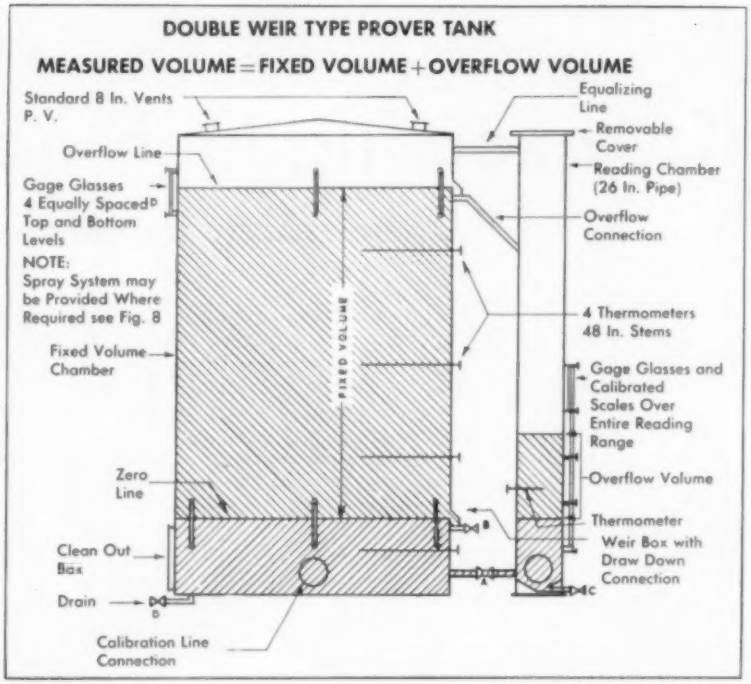
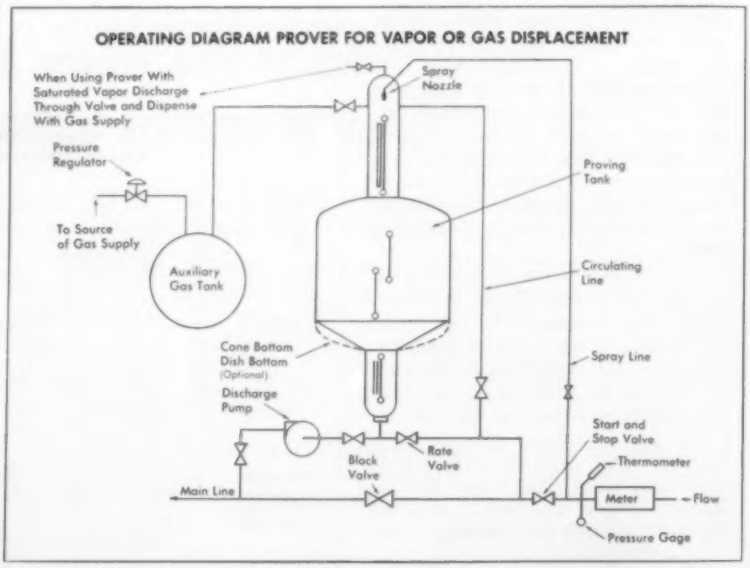

DOUBLE WEIR TYPE PROVER TANK
MEASURED VOLUME = FIXED VOLUME + OVERFLOW VOLUME
Standard 8 In. Vents P. V.
Equalizing Line
Removable Cover
Reading Chamber (26 In. Pipe)
Overflow Line
Gage Glasses 4 Equally Spaced Top and Bottom Levels
Overflow Connection
NOTE: Spray System may be Provided Where Required see Fig. 8
4 Thermometers 48 In. Stems
FIXED VOLUME
Fixed Volume Chamber
Gage Glasses and Calibrated Scales Over Entire Reading Range
Zero Line
Overflow Volume
Thermometer
Clean Out Box
Weir Box with Draw Down Connection
Drain
Calibration Line Connection

DOUBLE-WEIR open prover has second overflow weir, and uses overflow to measure added volume. Fig. 4.

with a second overflow weir. There is a fixed, calibrated volume between the levels of the two weirs and the amount of liquid which overflows the top weir during a proof is conducted to a supplementary small-diameter reading chamber having gage glasses and calibrated scales.

The equalizing line and valve "A" are used to assure that the level of liquid in the fixed-volume chamber and reading chamber are the same at the start of a proof run. "A" must be closed prior to the start of the test. The graduated gage-glass scale of the reading chamber may be made to indicate the total volume of the prover.

The tank should be supplied adequately with long-stem thermometers for temperature determination and



GAS-DISPLACEMENT prover uses gas pressure to maintain evaporation control of the test liquid. Fig. 5.

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- Less weight to transport
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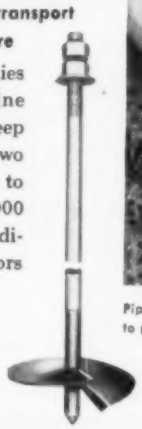
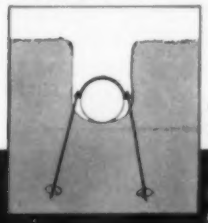
More and more progressive pipeline companies and contractors are turning to Chance Pipeline Anchors to eliminate costly counter weights to keep pipe from floating. A complete unit, consisting of two anchors and pipe saddle bracket, weighs from 29 to 180 pounds and will hold from 5,000 to 30,000 pounds. The anchors can be installed without additional excavation. Light power tools screw the anchors down in seconds.





Cut away view of anchors and bracket installed in trench.

Pipeline crew installing Chance Pipeline Anchors to prevent floatation problems in British Columbia.

Write for complete catalog and application information.

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with spraying means where test-liquid evaporation must be minimized. These weir-type open provers are considered useful for meters of high capacity such as may be used in pipeline and marine-loading service.

The petroleum industry meters a number of liquids where vapor pressures are such that excessive vaporization of the test liquid would take place if they were discharged into an open-type prover.

With such liquids as butane, propane, natural gasolines, and so on it is mandatory that a closed-type prover be used; i.e., one in which the test liquid can be confined under its reference pressure of measurement or slightly higher.

Additionally, meters which deliver to completely closed systems such as pipelines, and so on, require complete vaporization control during their proof to provide maximum accuracy. Some closed provers give better vaporization control than others and the extent of this will be pointed out in the description of the various types of provers.

There are about seven basic closed-type provers commonly used today, the first four of which can be operated as either gravimetric or volumetric systems. They are:

1. Gas displacement.
2. Vapor displacement.
3. Water displacement.
4. Vapor condensing.
5. Master meter.
6. Bidirectional piston displacement.
7. Unidirectional piston displacement.

Of this group, proving systems 3, 4, 6, and 7 can be expected to give perfect control of vaporization of any test liquid. Vaporization control in the master-meter method will depend entirely upon the manner in which the master is proved.

A typical gas-displacement prover is shown in Fig. 5. The system involves the application of gas pressure to the inside of the prover tank to maintain evaporation control of the test liquid. A preliminary filling of the prover with test liquid is made to establish the rate of flow, to wet the walls and equalize temperatures, and to adjust the gas-discharge pressure regulator to hold the desired pressure in the prover. Subsequent test runs are made, each time filling the tank with gas and displacing it with the incoming test liquid.

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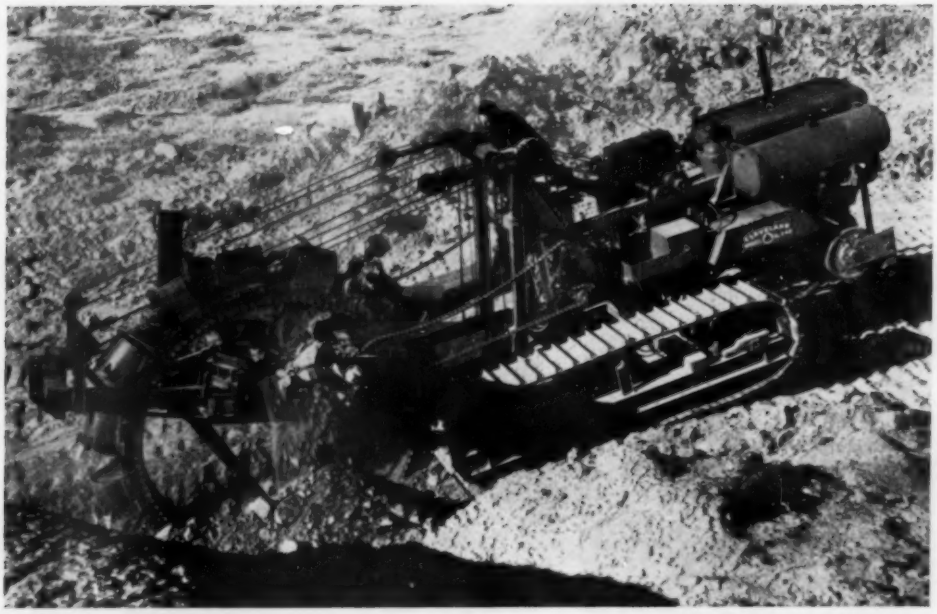

THE REDWASH OIL BASIN doesn't give a trencher much to dig in except hard rock, but this Cleveland 240 is making money for its owner as it grinds out trench for a flow line in rugged terrain 30 miles east of Vernal, Utah.

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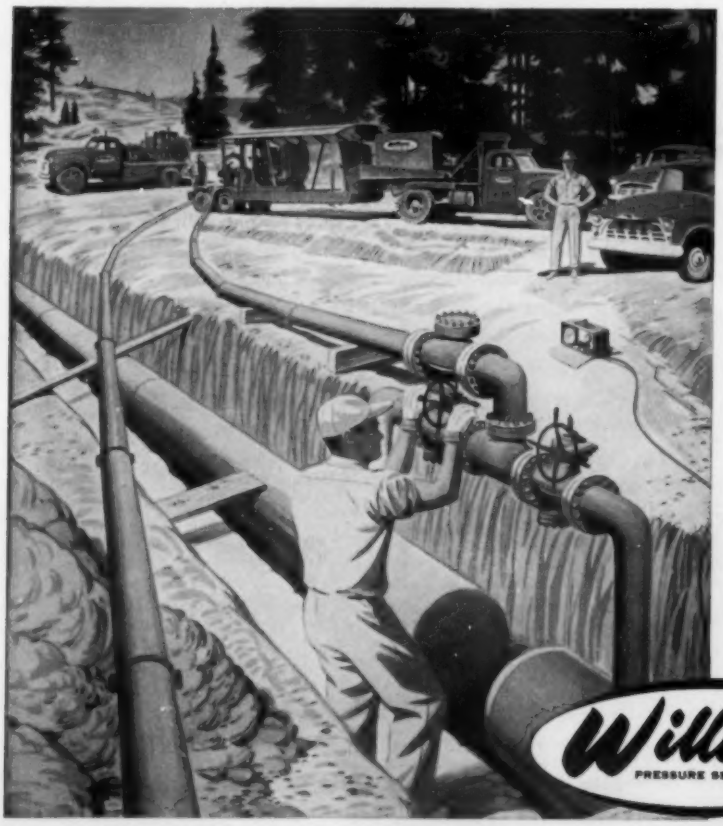

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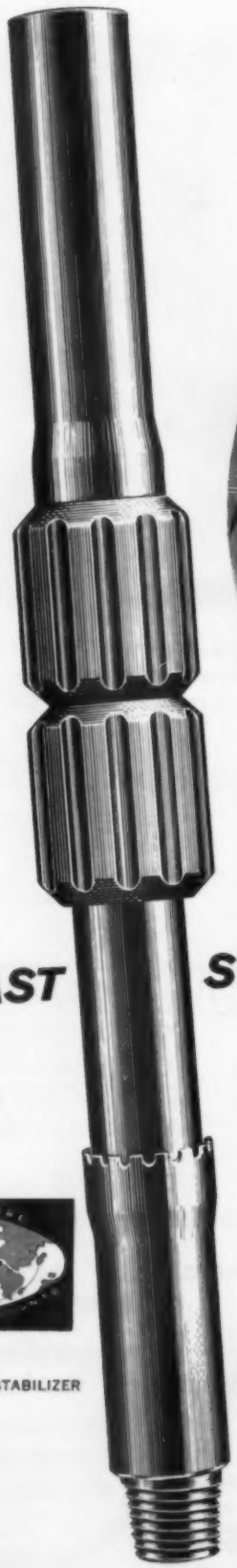

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Among the

Drilling Contractors

Llano Drilling Co., Midland, Tex., has a new 10,800-ft. operation scheduled for Forest Oil Corp. in Lea County, New Mexico. Its location, at 2-A State, in 26-16s-33e, is about 1½ miles northeast of Sanmal field, and about the same distance southwest of the Seaman field. This is about 15 miles southwest of Lovington.

C. B. Webster Drilling Co., Houston, has a rig under contract to Tidewater Oil Co. for a 13,000-ft. test about 4 miles southeast of the widely spreading Bastian Bay field, in the delta marshes of Plaquemines Parish, Louisiana. Location, on State Lease 192, is only a short distance inside the Gulf of Mexico coast line.

Prince Marine Drilling Co., Houston, is on a new wildcat job in northeastern Acadia Parish, South Louisiana. It is drilling for Southwest Gas Producing Co. It location, at 1 Daigle, in 37-7s-2e, is about 3 miles northwest of Church Point field, and about the same distance east of South Bayou Mallet field. A 10,500-ft. test is planned.

Occidental Petroleum Corp. announces it is moving ahead with its recently acquired Four Corners area acreage with the letting of contracts for immediate gas well drilling to **Rutledge Drilling Co.** of Santa Fe, N. M. The first well will be drilled as a Dakota test and will be in Occidental's west block, located in 8-26n-5w, Rio Arriba County, New Mexico. Company officials announce that all sands, including the Gallup and Dakota sands, will be tested for a possible accumulation of oil. The recent Dakota sand completion by Skelly Oil Co. of its 3 Roberts producer for 171 bbl. of 40°-gravity oil, lends particular interest to the subject area and the Occidental test. Occidental plans to twin a Picture Cliffs well at the location of the Dakota test immediately upon completion of the deep well.

Ocean Drilling & Exploration Co., New Orleans, La., has the contract on Shell Oil Co.'s latest wildcat operation in the Gulf of Mexico off the Louisiana coast. Location is in Block 171, Ship Shoal area, about 40 miles from the Terrebonne Parish shore line. Location is more than 5 miles southeast of Gulf Oil Corp.'s Block 154 field, nearest production. Shell calls for a 13,000-ft. test.

Gilmour Drilling Co. is moving on location in Bee County, Texas' Baumaker field, east of Skidmore. W. B. Cleary, Inc., and James H. Helland of Oklahoma City will drill 1-A Clara Driscoll estate and 1-B. The 1-A well will go to 4,400 ft.; the 1-B to 5,000 ft. Mud has held up operations, but Gilmour is due to move in on one of the two planned wells.

The 1-B well is in the T. Banuelos

DAY TOUR CREW on Helmerich and Payne Rig No. 48 which set a new depth record for air drilling. Hole was drilled from surface to 14,759 ft. with air. Left to right are: C. W. Hanson, floorman; Charles Harris, motorman; Neil Robinson, driller; L. S. Bankhead, derrickman, and G. W. Stillwell, floorman. The well is Hunt Oil Co. 1 Bustin Canon, in Terrell County, Texas.

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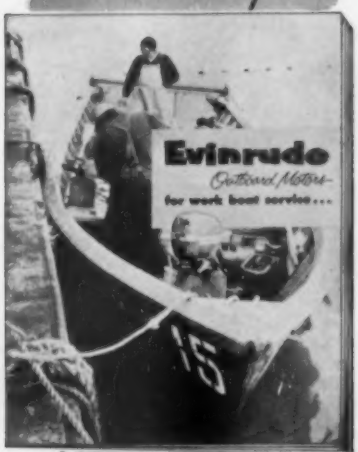

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& Stepson Survey, A-2; the 1-A well is 3,000 ft. south of a Union Producing Co. gas discovery on the Driscoll estate, completed 3 years ago.

Maxwell Herring Drilling Corp., Kilgore, has moved in rotary to drill an offset test to the discovery of Oak Hill field in northeastern Rusk County, East Texas. The operation is 1 W. S. Berry estate, E. C. Young Survey. Contract depth is 7,500 ft., expected to reach the Travis Peak.

Hewgley Drilling Co. had drilling under way on a rotary wildcat for Shell Oil Co. 11 miles south of Post in Garza County, West Texas. The project is 1 J. B. Slaughter "D," slated to 8,800 ft.

McCuthen - Graham Drilling Co. has contract for Continental Oil Co. 1 Pitchfork Land & Cattle Co., 7 miles west of Guthrie in King County, West Central Texas. The wildcat is scheduled to 6,100 ft.

Garvey Drilling Co. has contract for a field well in Cheyenne County, western Nebraska. The well is Petroleum, Inc. 2 Slama, C SW NE 28-15n-52w, Slama field. Location is in the Denver basin.

Murfin Drilling Co. will drill a wildcat for Stuarco Oil Co. at 1 Heidemann in C SW NW 14-13n-56w, Kimball County, western Nebraska. The well is in the Denver basin portion of Nebraska.

Sterling Drilling Co. has contract for a field well in Willson Ranch pool, Banner County, western Nebraska. The well is British-American Oil Producing Co. 16 Willson, C NW SE 13-17n-53w.

McKay Drilling Co. has contract for a wildcat in the Clearmont area of Sheridan County, Wyoming. The Powder River basin test is Davis Oil Co. 1 Iroz, C NE SE 20-54n-79w. Plans call for a 6,800-ft. Parkman-Cretaceous test.

Tenison Drilling Co. is contractor for Petroleum Corp. of America-Tom Jordan, Jr. 1 Lucy, a Burke County wildcat in northern North Dakota. The wildcat, part of the booming play along the state's northern border, is in SE NE 27-160n-92w. It will be a Nesson-Mississippian or Midale test.

Brack Drilling Co. is contractor for a Chase County, Nebraska, wildcat for Prize-Kee Petroleum Co. The well is the 1 Fanning, a 4,800-ft. granite test in NE NE 26-7n-36w.

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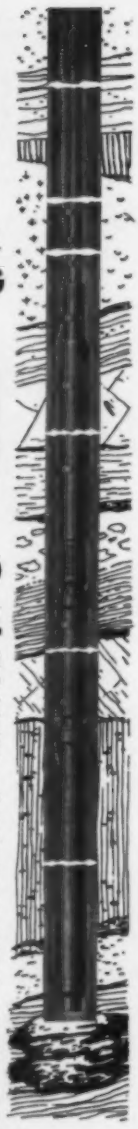

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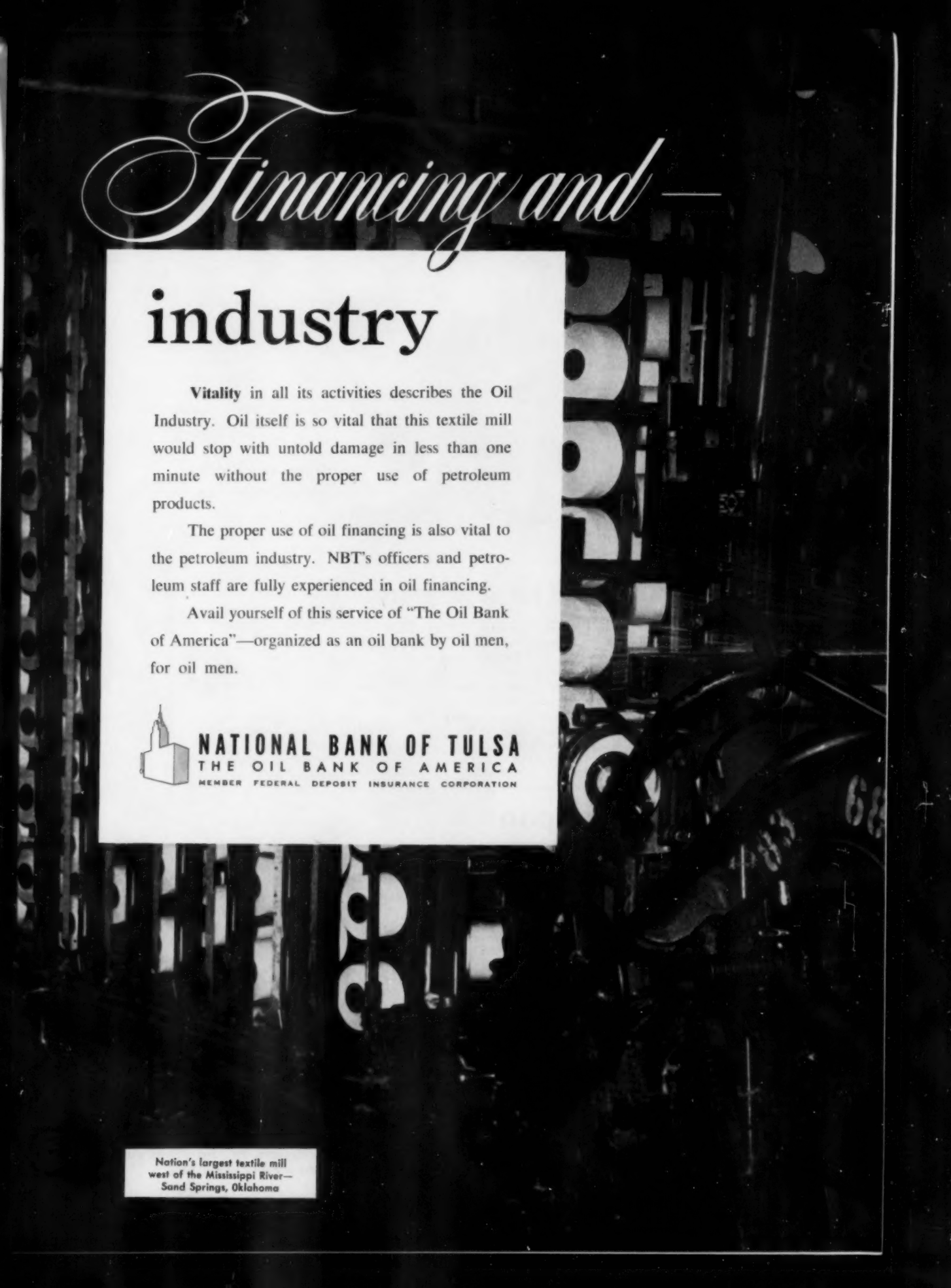
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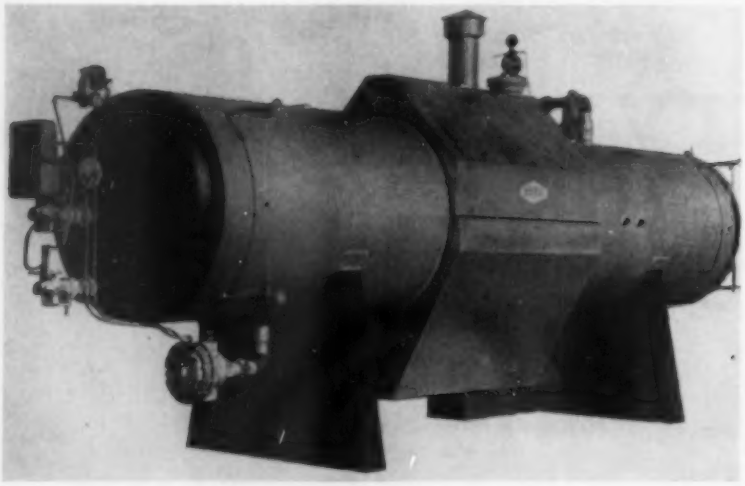

Detachable heater used for separators

To give peak efficiency in cold-weather operations, this new 200,000-B.t.u. detachable heater for Odex three-phase separators prevents freezing of water, coagulation of viscous crudes, and paraffin accumulation on vessel walls. It also treats small volumes of emulsified crudes.

The separator is designed to measure oil, gas, and water at 99 per cent accuracy or better, providing production data for both individual well tests or completely automatic battery systems. It can be adapted for the remote recording of information by the addition of pulse switches.

According to the maker, the separator can save time in testing a well or wells continuously without typing up lease-storage facilities. Also it provides detailed test data and can be used to commingle dual-zone production and/or royalty accounts while reducing storage and treating needs. The separator is available with or without the detachable heater unit. **Write or call: Odex Engineering Co., 1410 North Grant, Odessa, Tex., for details on three-phase separator and detachable heater.**

●

Spark Plug Aids Fuel-Combustion Test

The new patented, pressure-sensitive spark plug has been developed to analyze engine operation and combustion characteristics of various types of fuels when they are burned in internal - combustion engines. Extended usage under all types of mobile engine testing for as long as 400 hours has resulted in proved performance, the maker reports.

A high-temperature strain gage is bonded to a pressure - sensitive diaphragm. It transmits an electrical signal proportional to engine-cylinder pressure that can be displayed on an oscilloscope.

Exact timing and indication of cylinder pressure, ignition, preignition, knock, and other engine-pressure pulsations are accurately sensed and displayed. Application of the pressure-sensing element to a conventional spark plug permits regular spark-plug installation, normal ignition and combustion, and unaffected engine operation, according to the maker. **Write or call: Polyphase Instrument Co., Bridgeport, Pa., for details on pressure-sensitive spark plug.**

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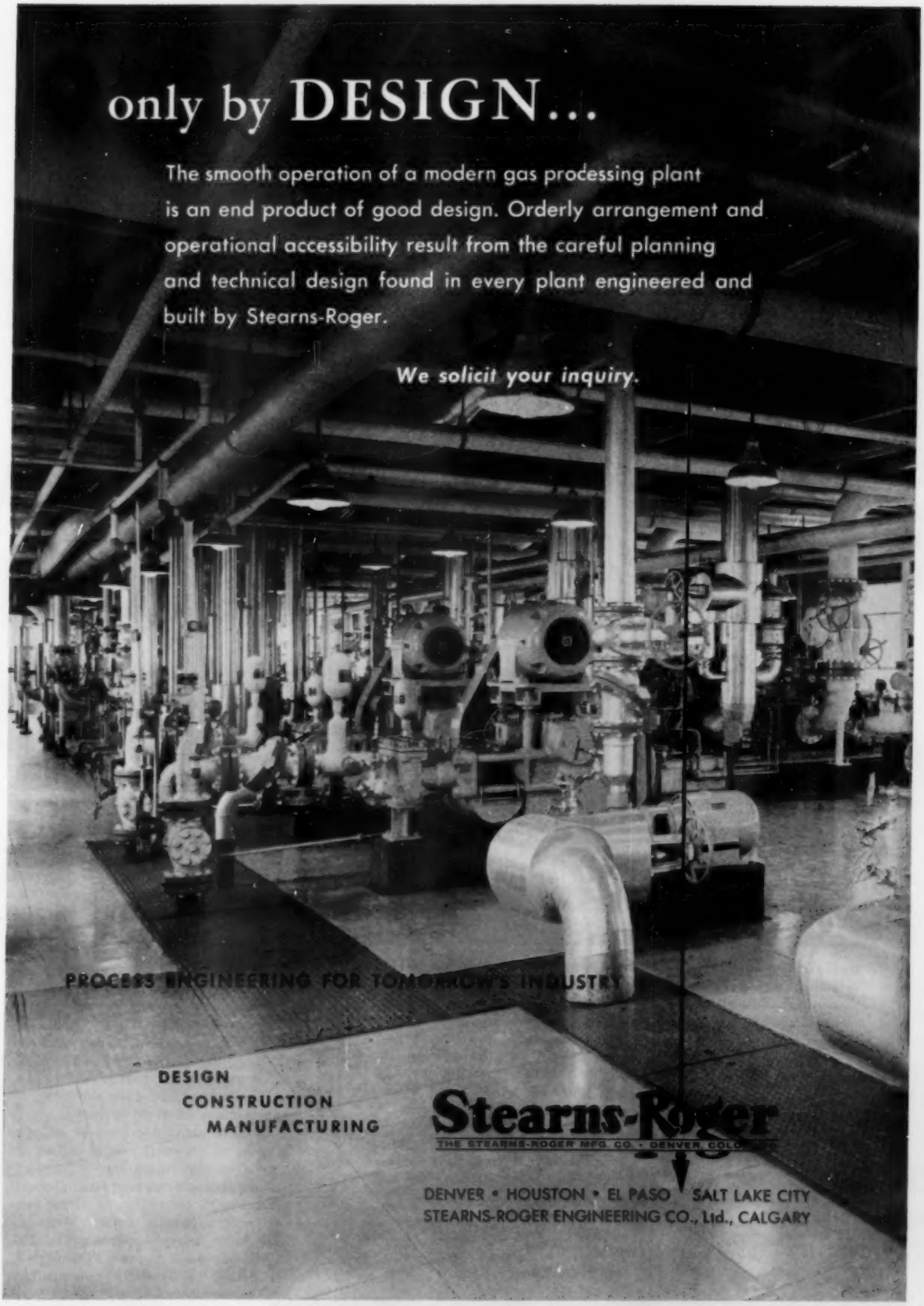
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SHOWCASE . . .

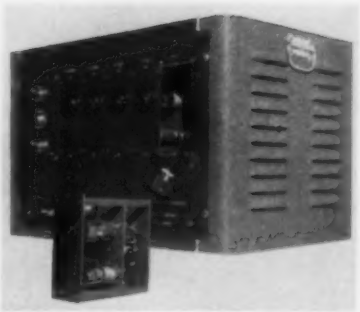
New Equipment

Central Counter Gives Remote Readings

Totals on widely separated electrical or mechanical-driven counters can be read remotely without destroying or changing the readings on the counters with this new McEvoy remote-reading counter. The counter permits its operator to gather at one central point up-to-the-second reading from any metered operation monitored by a digital counter.

He can determine the reading on a separator-dump counter and then, with the same equipment at the same central location, read a pipeline flowmeter total miles away. In conjunction with a McEvoy dial-selector, the counter can be used to read any number of distant counters, regardless of the number of digits on each one.

A pair of wires, telephone lines, or radio can be used to transmit readings automatically at set times or on call from the central read-out unit.



Write or call: Controls Div., McEvoy Co., P. O. Box 3127, Houston 1, for details on remote-reading counter.

●

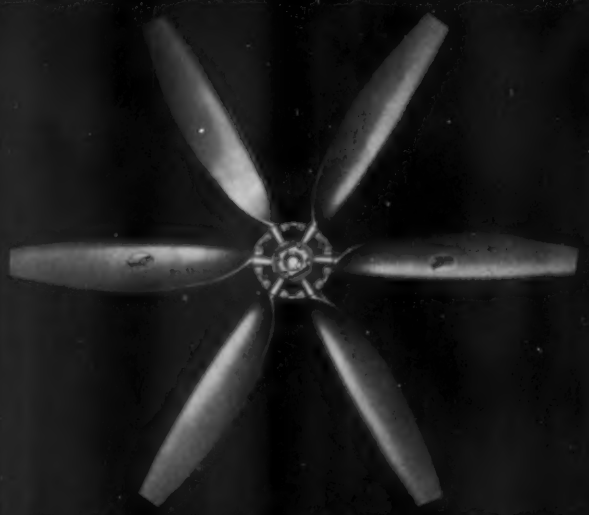
Analyzer Measures Combustible Gases in Air

Designated the Model F, the combustible - gas analyzer is designed to provide flexible, centralized instrumentation for process control and industrial safety. It does this by continuous or intermittent sampling and measurement of combustible gases and vapors in mixtures with air at normal or high temperature. Two important components of the analyzer are the sensing element and the analyzing head. The sensing element or filament is designed for extremely long life. The remote-analyzing head with explosionproof housing operates at high temperature. It analyzes hot samples in the area of their occurrence without danger of condensation of combustible vapors, the maker reports.

Any of three basic systems can be obtained by arrangement of the five subassemblies or units. These systems can provide: (1) continuous tube sampling of up to six individual stations, (2) continuous remote-head sampling of as many as six individual stations, or (3) intermittent tube sampling of a maximum of eight stations.

Monitor units are used in all systems—one for each sample station or each group of intermittently sampled stations. Each monitor includes an indicating meter calibrated in per cent of lower explosion limits. **Write or call: Mine Safety Appliance Co., 201 North Braddock Avenue, Pittsburgh 8, for details on Model F combustible-gas analyzer.**

HARTZELL All-Aluminum
Cooling Tower and Heat Exchanger Fans



stand up under the toughest operating conditions

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- Blade shanks are threaded to fit threaded blade housings cast into hub. Blades may be turned to change pitch by merely loosening two bolts.
- Because all hubs are dynamically balanced and all blades balanced against a master blade, damaged blades may be replaced in the field without destroying the balance of the assembly.
- Eleven sizes, 40″ to 132″ diameters; 3, 4 and 6 blade assemblies.
- For complete details, call your nearby Hartzell field engineer or write for your free copy of new Bulletin A-111B.

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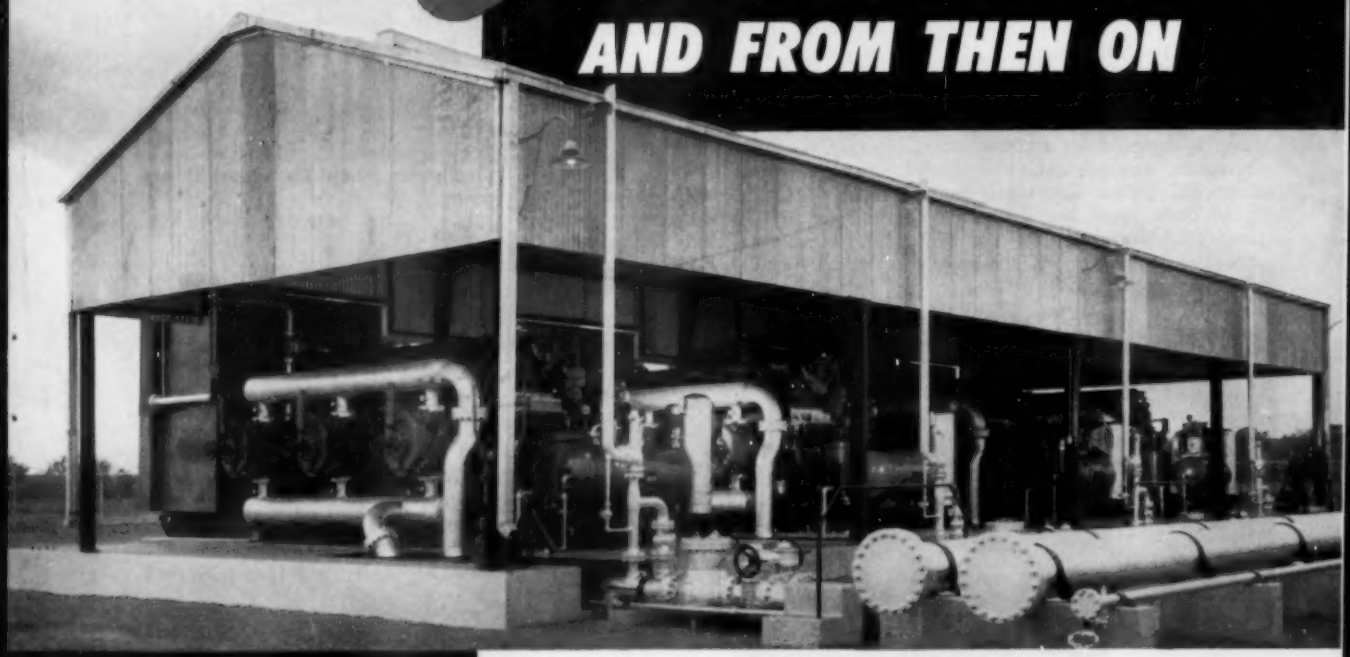

Industrial Gas Supply Corporation, Needville, Texas, Compressor Station.

Southwest packaged gas compressors for main line stations

Illustrated above is an installation of four 660 hp Southwest-Cooper Bessemer GMXD-10 Packaged Compressors, handling Industrial Gas' total line capacity of 100 MMCF/D.

Southwest Packaged Gas Compressors for main line compression are **being** installed for **less than $200 per horsepower.** And they will be running months before field assembled units can be built!

Lower first costs are only part of the story. Unattended operation, possible with the automatic controls and safety devices on Southwest Packaged Compressor Plants, cuts operating cost per horsepower-hour to a fraction of the cost of a fully attended installation.

The final economy for your pipeline is that this station never need be shut down completely. In South Louisiana, the capacity of a main line station with eight 660 hp Southwest units, is reduced only 12½ per cent when one unit is down. However, if two 2600 hp units were used instead, capacity would be reduced 50 per cent when one unit is down.

These are all proved facts. Southwest engineers can show you the **results** and savings pipelines are realizing now with Southwest Packaged Gas Compressors.

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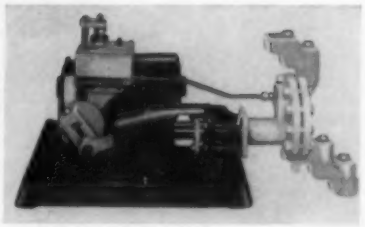
New Equipment

Chemical-Metering Pump Prevents Leaks

The controlled-volume diaphragm pump is designed for metering toxic, obnoxious, corrosive, and/or costly chemicals. Teflon diaphragms seal its liquid ends from the plunger and housing. Accurate to within ± 1 per cent, the pump is a positive-displacement metering type.

The plunger displaces hydraulic fluid which, in turn, strokes the diaphragm to impart pumping action through double-ball checks. No mechanical connection exists between the diaphragm and plunger.

Available with maximum capacities from 1.1 to 139 gal./hour and pressures to 2,000 psi., the diaphragm pump has manual or automatic capacity adjustment from 0 to 100 per cent. With automatic capacity adjustment, it can be useful in chemical instrument systems. **Write or call: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, for details on**



diaphragm pump for chemical metering.

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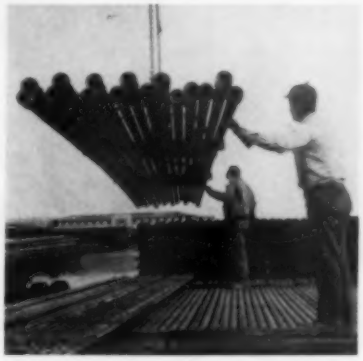
Pipe Handler Speeds Loading, Unloading

The pipe-handling equipment comes in 5 to 31-joint units to accommodate all sizes of pipe. Over 1,300 joints per hour can be transferred from a barge to a rail car with one operator and two helpers, the maker claims.

Designed to eliminate physical fatigue, the Protolift is said to decrease accident rates while increasing volume of production. Its cost ranges from $2,400 to $6,000 f.o.b. Houston.



The size of the unit or the number of joints accommodated by a unit is limited only by the lifting power available. **Write or call: Leo Reel-Protolift Co., West Building, Houston, for details on Protolift equipment.**

●

Preheater Makes Stored Oil Flow Easier

The Hot-Spot preheater is a simple means to preheat heavy liquids in a bulk tank before they enter a pump suction line. It is a shell-and-coil assembly that lowers into the tank through the manhole. Inlet and outlet pipes are provided for heating by steam or hot water. Holes for supply and return pipes and for the fluid-suction pipe are made in the manhole cover by drilling or torch cutting.

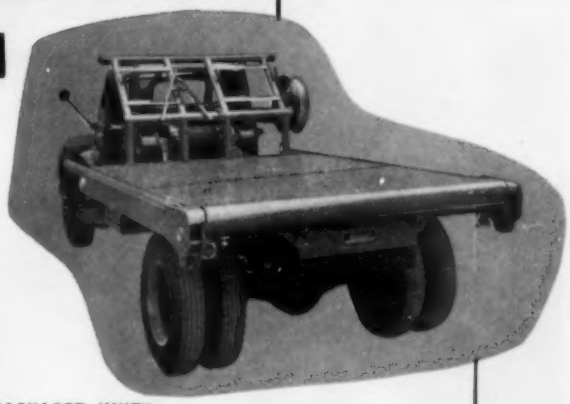
A flow accumulator causes oil or other liquid to flow over the heated pipes before it enters the suction line.

110-VOLT HOLIDAY DETECTOR
MODEL EPAC
POWER ON OFF
BELL ON OFF
Economical, high-performance test instrument for plant use in locating coating perforations
ADJUSTABLE VOLTAGE REGULATOR
This instrument is designed for use at permanent pipe yards or railheads using 110 to 115 volt AC power. Voltage output can be adjusted externally in a range from 5000 to 20,000 volts.
EASILY PORTABLE
Detector unit in metal case with lift handles weighs but 13¼ pounds and is easily carried by one man. It can be set near the work or may be used with electrodes on long cords.
BELL SIGNAL
When an electrode attached to this detector finds a "holiday," scratch, hole, burned or coked spot in pipe wrappings its sharp, pulse-type voltage grounds on the pipe and signals the operator by a prolonged ringing of a bell.
MANY TYPES OF ELECTRODES
Unit may be ordered with Tinker & Rasor spring electrodes (either half or full circle), new non-fouling, conductive, silicone rubber flat blades on wand handles or wire brush type.
Write for literature . . .
TINKER & RASOR
417 Agostino Rd. (P. O. Box 281), SAN GABRIEL, CALIF. • Phone: ATlantic 7-7942

DISTRIBUTORS: Crutcher-Rolfs-Cummings, Inc., Houston, Texas, Remco Manufacturing Company, Inc., Tulsa, Oklahoma, Canadian Equipment Sales and Service, Ltd., Edmonton, Alberta, Bob Herrick, Rentals and Service, Harrisburg, Penna., Falcon Line Products Corp., Elizabeth, New Jersey • Export Agents: Frazar and Hansen, Ltd., San Francisco, California.

Leland design
with your next job in mind

FIFTH WHEEL BODY



"PACKAGED UNIT"

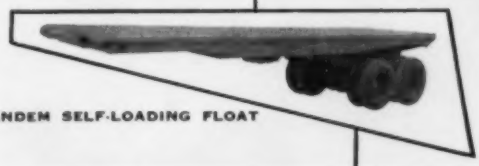
Looking ahead to the requirements of tomorrow's heavy construction is a part of Leland's business, and the advanced design of the rugged "Packaged Unit" is *rolling evidence* of anticipating our customer's needs.

This powerful, all-purpose truck body is no stranger to off-the-highway construction, for it's specifically designed and built for gin pole winching and tough terrain work. Leland's "Packaged Unit" is famous throughout the world for its flexibility and versatility of performance in the field.

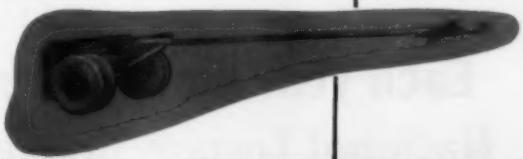
For your best body buy, think ahead and look ahead. That's where you'll always find Leland waiting — way ahead!

Leland's other heavy-duty truck bodies are built for the future, too . . .

SELF-LOADING FLOAT SEMI-TRAILER



TANDEM SELF-LOADING FLOAT



POLE TRAILER

TANDEM POLE TRAILER

FIFTH-WHEEL BODY — RELIABLE FOR TRAILER, GIN POLE OR FLAT BED WORK. POLE TRAILERS — SINGLE AXLE & TANDEM—STREAMLINED BUT RUGGED CONSTRUCTION MEANS "SOLID SERVICE".

SELF-LOADING FLOATS, SINGLE AXLE AND TANDEM — DESIGNED FOR INCREASED PAYLOADS AND REDUCED MAINTENANCE COSTS.

PARTS . . .
for Thew-Lorain, Cleveland Trenchers, Gardner Denver, Blaw-Knox, Cedarapids, C-M-C Tulsa Winches.

Leland
EQUIPMENT COMPANY
Oklahoma City • TULSA • Longview, Texas

SERVICE . . .
quick and efficient, on construction equipment parts, anywhere in the country.

Each year more and more National Torque Converters help to find more and more oil!

The problems you once encountered in drilling rig operation triggered the development of the National Torque Converter . . . and over the years have imposed its toughest tests.

How soundly the converters were designed, how well they are constructed, and how efficiently they do their jobs, is best indicated by the steady increase in the units sold for oil field service. In the past five years, annual sales have increased almost 600%.

Both manufacturing and warehousing facilities are organized to speedily fill these expanding needs. National Torque Converters are available as original equipment on ten of the best-known rigs made in this country, and can be ordered as a "package" on the prime movers of sixteen leading engine builders. For further information just write:

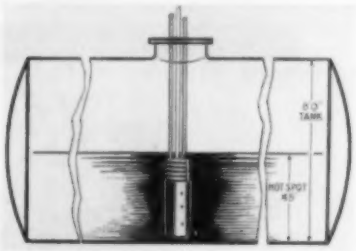
THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

Two Gateway Center, Pittsburgh 22, Pa.

Pace-setters in the progress of industrial power transmission

Pipes are furnished in the proper length for any diameter tank. The coil is a 1½-in. steel pipe, extending the depth of the shell. The shell is 12-gage sheet steel. After fabrication, the preheater is tested with air at 400 psi. under water.



Two preheater sizes are available—16-in. shell diameter for manholes with a 16½-in. or larger opening, and 14-in. shell diameter for manhole openings with a 14½ to 16-in. diameter. Approximate shipping weight of the preheater is 275 lb. **Write or call: Rempe Co., 340 North Sacramento Boulevard, Chicago 12, for details on Hot-Spot preheater.**

●

Automatic Bypass Valve Regulates Pump Discharge

Made of bronze and giving a high capacity, the automatic bypass valve for regulating liquid pressure as supplied by pressure pumps has a valve set to open at the required pressure.

Models are available with fixed setting for relief-to-atmosphere applications. The valve is available in two sizes—¾ and 1 in.—for pressures from 10 to 250 psi.

Designed for pop action, the valve has a high-capacity characteristic. For example, the ¾-in. size., set at 100 psi., will bypass 42 g.p.m. **Write or call: Watts Regulator Co., Lawrence, Mass., for details on bypass valve.**

why?

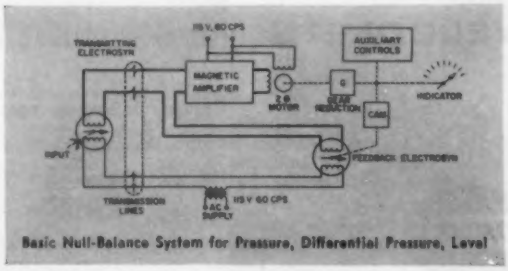
More and more leading pipeline companies are choosing

NORWOOD CONTROLS **ELECTROSYN SYSTEMS**

to measure and indicate operation pressures and flows, and for digital telemetering...

Basic system consists of signal transmitter, magnetic servo amplifier, null-balance indicator. (No electron tubes, slide wires or continuously moving parts.)

In measuring pressure, the Model 501 transmitter utilizes a twisted bourdon tube as the pressure sensing element. This tube converts the pressure into shaft rotation of the ElectroSyn signal generator, a rotary differential transformer. The 8½-volt signal output from the ElectroSyn signal generator is an a-c voltage exactly proportional to the measured variable. Write for ElectroSyn Brochure B257 — **Norwood Controls Unit, Detroit Controls Division, 942 Washington St., Norwood, Mass.**



Basic Null-Balance System for Pressure, Differential Pressure, Level

because ElectroSyn offers:

- Higher reliability
- Lower maintenance
- Flexibility of application
- Rugged electro-magnetic system
- Can withstand static overload of 300% of rated pressure for a 1% zero shift
- Remote transmission
- Explosion-proof transmitters

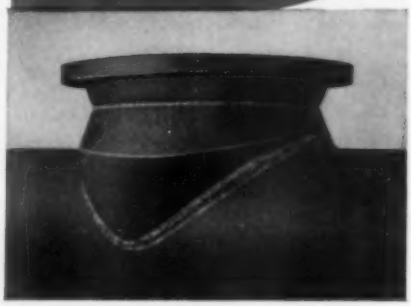
AMERICAN-Standard PRODUCTS

AMERICAN-Standard

DETROIT CONTROLS DIVISION

Note rugged branch construction on this massive oil header fabricated with a length of pipe and five 30 x 12 and two 30 x 30 weldolets.

BIG PIPE
BIG MONEY
to be SAVED
by using
30 x 30
BONNEY
WELDOLETS



Closer manifolding, ease and speed of field fabrication without header distortion, lower purchase and welding costs are just a few of the profit benefits of header fabrication with Bonney Weldolets. Today there is particular need for reducing costs. Bonney Forge can provide this opportunity for cutting costs in your company. Write, phone or wire for details.

BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®

CARBON STEEL
STAINLESS
ALLOY
for all services

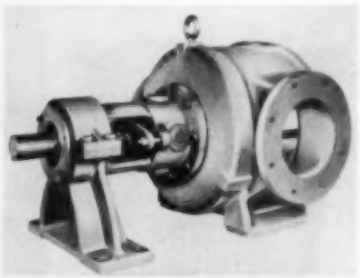
BONNEY FORGE AND TOOL WORKS

Dept. H

ALLENTOWN, PENNSYLVANIA

Rotary Pump Moves Thick or Thin Liquid

Pump capacity ranges to 1,200 g.p.m. at 100 psi. The pump is suited for general-transfer, metering, and other services.



Efficiencies as high as 90 per cent are claimed for the pump. These are achieved through the use of few sealing surfaces and proper rotor and idler dimensions for any given fluid viscosity to reduce viscous drag.

Direction of flow may be reversed, regardless of shaft rotation. The pump is available in materials for handling a variety of liquids. **Write or call: Seren Machine Products Corp., 1800 West Fulton Street, Chicago 12, for Bulletin 5135C.**

●

Thermometer Fits Limited-Space Areas

Available in ranges to 200-1,000° F., the Model G thermometer has a head diameter of only 1¾ in., making it ideal for installation on equipment where mounting space is limited. It employs a direct-drive bimetal coil principle which eliminates gears and linkage.

Constructed entirely of stainless steel (except for the aluminum and black crystal-protected dial), it is moisture sealed, overheat protected, pressureproof, and individually calibrated for peak accuracy.

Available in 11 ranges, the Model G can be obtained with a stem length as short as 2½ in. or as long as 72 in. **Write or call: W. C. Dillon & Co., Inc., 14620 Keswick Street, Van Nuys, Calif., for details on Model G thermometer.**

SHOWCASE . . .

New Literature

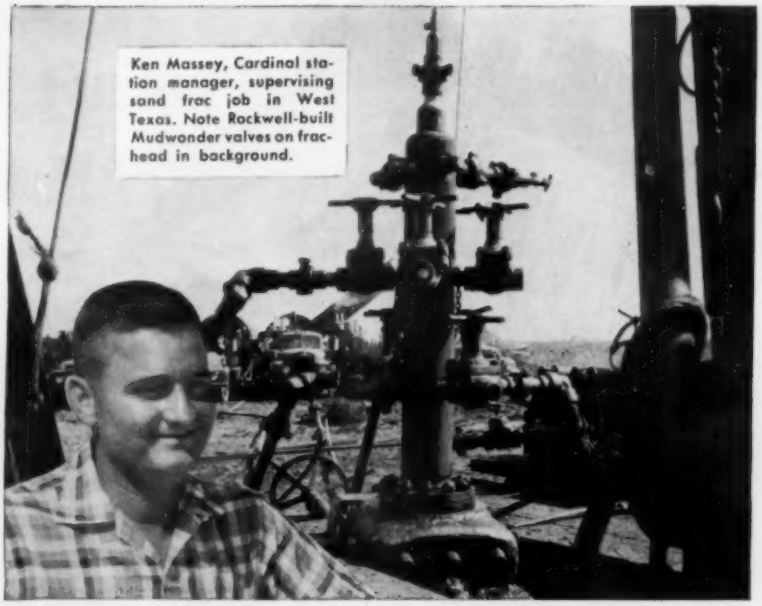
Steam condensers . . . for use under vacuum at ground level are described in new Bulletin 5AB. These units are used in industrial processes and in connection with steam engines and turbines. The range of capacities offered by these units, and the fact that they do not require a barometric leg—but discharge directly into a hotwell—make them ideal for the average steam unit or industrial installation designed to operate under vacuum, the maker says. The bulletin contains application, construction, and operation information. Complete sizing data is included for both eductor condensers and multijet condensers. Sizes available, capacities, weights, and dimensions also are provided in tabular form. **Write or call: Schutte & Koerting Co., Cornwells Heights, Bucks County, Pennsylvania, for Bulletin 5AB.**

Sheet packing, gaskets . . . of homogeneous compressed asbestos are described in a new eight-page bulletin. Listed in the bulletin are 120 chemicals that can be handled safely by gaskets cut from the material. Also included are tables giving stock sizes of sheets in five different gages. Prices and dimensions of gaskets for cast-iron pipe flanges and flanged fittings and raised-face cast-steel flanges are also listed. Gasket dimensions are per specification ASA B16.21—1951. **Write or call: Durabla Mfg. Co., 114 Liberty Street, New York 6, for Asbestos Sheet and Gasket booklet.**

Handling propane safely . . . and at lower costs is discussed in a new booklet. The booklet gives precautionary measures to assure safe propane service for producers, industrial users, and distributors. Methods for assuring accurate deliveries, safety practices during loading and unloading, preventive maintenance, driver training, and safety programs are described and illustrated. **Write or call: E. Brooke Matlack Co., Inc., Thirty-third and Arch, Philadelphia 4, Pa., for Propane Transportation booklet.**

Oxy-acetylene welding . . . and cutting equipment is featured in the revised 36-page 1958 Welding Equipment Catalog 160. It covers recommended applications of oxy-acetylene welding and cutting torches, air-acetylene torches, machine cutting

Tips on Valves for Service Companies..



Ken Massey, Cardinal station manager, supervising sand frac job in West Texas. Note Rockwell-built Mudwonder valves on frac-head in background.

We maintain sand frac fluid pressure with Mudwonder Valves!

by Kenneth Massey,
Odessa Station Manager
Cardinal Chemical Company

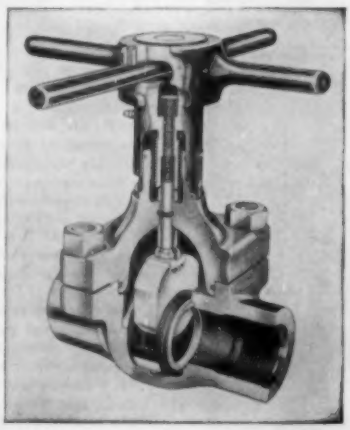
WE fracture oil wells. It's our job to get the maximum number of barrels pumped in the shortest possible time. That's why we use the best, most dependable equipment available—and drive it hard. When we finish pumping the sand frac fluid in under high pressure and close the well-head valves, we've got to be *sure* they don't leak. For two years now, we haven't had to worry. We find that well pressure never bleeds off when our Mudwonder valves are closed. There's no need to bump them shut or use a "cheater" to get drop-tight shut-off.

We now have 40 two-inch Mudwonders and several three-inchers. You might think maintenance would be a headache—but our Mudwonders don't seem to need much in the way of repairs. The only part that wears to any extent is the seat insert, which we can replace in a couple of minutes between jobs.

At the present time, we're using Mudwonders at all of our stations—Odessa and Levelland, Texas, and at Hobbs, New Mexico. We're thoroughly sold. Mudwonder valves are doing a great job for us, both on sand fracing and in acidizing.

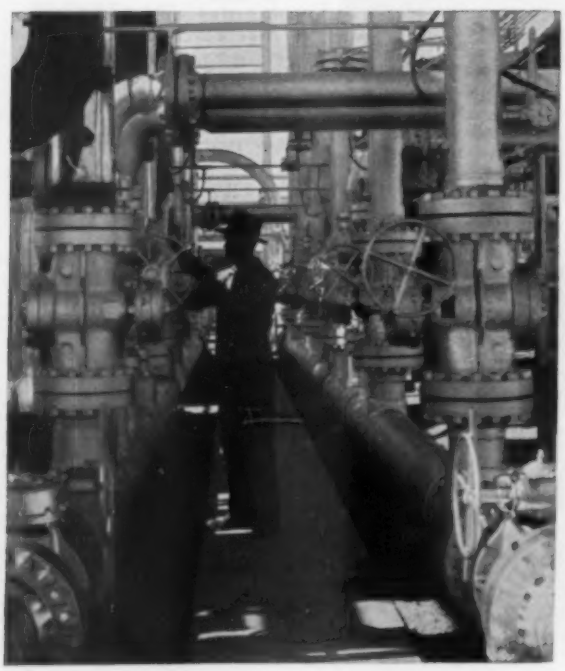
Mudwonder valves are built in 2", 3" and 4" sizes; with screw or flange ends; for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., East Chicago, Indiana, subsidiary of Rockwell Manufacturing Company.

Mudwonder cut-away view shows the one-piece seat insert, with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



(Advertisement)

With Republic



YOU CAN GET THE CORROSION PROTECTION OF PLASTIC PLUS THE STRENGTH OF STEEL with Republic's new X-TRU-COAT pipe and tubing. Actually two pipes in one, plastic over steel, X-TRU-COAT is ideal for a wide variety of applications in which external corrosion is a problem. The tough polyethylene coating is continuously extruded over a special elastic adhesive undercoat forming a solid, permanent bond with the steel pipe. X-TRU-COAT can be bent and joined by conventional methods. Joints are corrosion protected by a primer covered with pressure-sensitive tape. For details, send coupon.

YOU CAN SECURE THE FASTENERS YOU NEED for almost any conceivable assembly when you specify Republic Bolts and Nuts. Available in over 20,000 standard and 8,000 special types and sizes, Republic Fasteners provide clear-through dependability based on coordinated quality control from raw ore to finished products. In addition, full-formed heads and clean, accurate threads simplify assembly and provide easy back-off whenever required. For further information, check your local distributor or mail coupon.

"SUPER-SPAN" Fusion Weld Line Pipe
YOU CAN MAKE 2+2=6

When does 2+2=6? Every time—when you compare the distance covered by 60′ Republic "SUPER-SPAN" Line Pipe Joints with ordinary 40′ joints. Since four "SUPER-SPANS" equal six ordinary joints, in a 45-mile line you eliminate 1980 field welds! In other words, you can lay 50% more pipe line footage with no increase in your welding force. Potential dollar savings are substantial.

In addition to reduced field welding requirements, you gain other important advantages with Republic "SUPER-SPAN" Fusion Weld Line Pipe. Made up of two 30-foot joints, the 60-foot "SUPER-SPAN" retains the same excellent uniformity of diameter and wall thickness, plus high ductility and yield strength found in all Republic Line Pipe. These factors mean fast line-up and field welding with no risk of burn-through due to thin spots. Moreover, accurate field bending is simplified and dependability in high pressure service assured.

Finally, center girth welds on Republic "SUPER-SPAN" are produced under controlled conditions by automatic submerged-arc welding equipment. Their reliability equals that of the longitudinal welds.

For full information on Republic "SUPER-SPAN", or any of our complete line of tubular products, contact your local Republic office. Send coupon for data.

YOU CAN HAVE LOW-COST HOUSING with complete flexibility to meet changing conditions when you use Republic's new Truscon Steel "Budget Buildings" for pumping and compressor stations, for equipment and material storage, or for personnel use. Available in a variety of sizes and types, "Budget Buildings" are easy to erect, dismantle, store, and re-erect as required. A tight galvanized coating eliminates the need for painting. Buildings are shipped as a package including all roofing, siding, windows, doors, and hardware. Send coupon for facts.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

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DEPT. C-5154
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Please send me more information on:

- ☐ Line Pipe
- ☐ Truscon Steel Buildings
- ☐ X-TRU-COAT Pipe and Tubing
- ☐ Fasteners

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

torches, and welding regulators. It also lists industrial regulators, pressure gages, tank couplings, adaptors, hose connections, and safety instruction manual. **Write or call: Modern Engineering Co., 3409 Pine Boulevard, St. Louis 3, Mo., for Catalog 160.**

Industrial minipump . . .

is the title of a two-page bulletin that describes and illustrates Milton Roy's new addition to its line of controlled-volume pumps. These pumps are built for application which require laboratory accuracy with industrial ruggedness. Bulletin 1257 gives complete details on specifications, design features, materials of construction, and dimensions. Typical applications described include the metering of small quantities—3 to 7,880 ml. per hour—of corrosive or costly chemicals. **Write or call: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, for Bulletin 1257.**

Wrought-iron piping . . .

booklet documents typical wrought-iron pipe installations. The eight-page booklet presents case histories selected to show wrought iron's durability under a variety of operating conditions. Featured in the case histories is the colorful story of a wrought-iron siphon installed in 1873—and still in use today—to transport water from high in the Sierra Nevada's to Virginia City, Nev. ASTM specifications under which Byers pipe is manufactured are in the booklet. And photomicrographs show the physical structure of the material. **Write or call: A. M. Byers Co., Clark Building, Pittsburgh 22, for Wrought Iron O. D. Piping booklet.**

Radioactive isotopes . . .

and isotope-labeled compounds are covered in new Price List C. This publication adds to previous issues an expanded list of carbon-14 compounds. Sections describe heavy water, deuterium, and tritium-labeled compounds, and new nitrogen-15 compounds of high isotopic concentration. The booklet contains a convenient alphabetical list and cross-reference. Hydrocarbons, alcohols and derivatives, plant-growth regulators, benzene-ring-labeled compounds, and steroids are also priced. **Write or call: Bio-Rad Laboratories, 802 Delaware Street, Berkeley, Calif., for Price List C.**

Heat-exchanger . . .

improvements and design features are detailed in new Bulletin 1.1K6. Among the principal features described are baffles with a special flanged lip at each tube hole and around the rim for a tight tube fit. Also featured are stamped-steel feet that move in three positions around the hubs for easy mounting. The corrosion-resistant copper-alloy core assembly and hubs relieved under connections for unrestricted flow are also described. Specifications cover 46 sizes in one, two, and four-pass designs. **Write or call: Ross Heat Exchanger Div., American Standard, Buffalo 5, N. Y., for Bulletin 1.1K6.**

Filter-area calculator . . .

working on the slide-rule principle is now available free. Pocket size, the calculator speeds determination of square feet of filter area required in liquid-solids separation. On one side of the calculator, required area is given in terms of filtration rate. On the reverse side, required filter area is calculated on the basis of cake capacity. The greater of the two area requirements obtained is the square feet of filter area to use. **Write or call: Niagara Filters Div., American Machine and Metals, Inc., East Moline, Ill., for Filter Area Calculator.**

NEVER AGAIN!
cut - fit - trim - refit - recut - refit

PAT. NO. 2408517

do it once — do it right!

with the H & M SHAPE CUTTER

Accuracy in cutting or beveling saddles, tees, els, or other designs has long been a time-consuming, trial-and-error process in pipe fabricating. No longer, however!

Today, you can produce *precise* cuts and bevels *the first time* — with an H & M Shape Cutting Attachment!

The H & M Shape Cutter is actually steered around the guiding template by exerting the proper spring tension on the sliding torch assembly. The cutting torch is thereby *forced* to reproduce the exact shape desired.

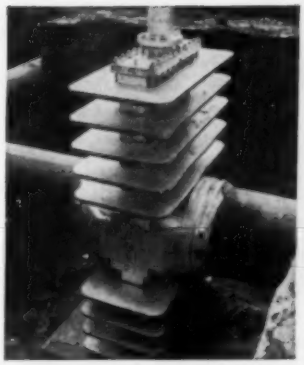
Eliminate those costly "re-cuts" and "re-fits" by equipping your shop or field crew with an H & M Shape Cutter. Then — do it once, and you've done it right!

Full details are available immediately. Write or wire.

H&M
PIPE BEVELING MACHINE COMPANY
311 E. Third St. Diamond 3-0241
TULSA, OKLAHOMA

Perfect through-conduit alignment simplifies hot tapping through this 22" ASA 600 valve.

34" full opening high pressure gas valve will stay bubble-tight underground—with no lubrication or maintenance.



Ease of operation is of prime importance on frequently used manifold installations.

PERFORMANCE in the field points up the BIG DIFFERENCE

— in bubble-tight seal you can check in the line
— in easier operation with no wedging or jamming
— in lower maintenance with no need for lubrication
— in through-conduit always in line with the line

Thousands of pipeline, manifold and storage installations in gas and liquid services are daily adding to the record of performance that makes Grove *Seal-O-Ring* Gate Valves stand out as the practical answer to operating problems. If you have any doubt, ask men who are using them. It will pay you to specify Grove *Seal-O-Ring* Valves with the fabricated steel body—2" to 36"—in any standard pressure. Call your Grove representative or write today for details.

THE WHOLE VALVE IS RIGHT HERE

When valve is full open or closed, bubble-tight seals on both sides of the gate completely isolate line pressure in the conduit. The body, serving merely as framework for operating mechanism and to prevent loss of product while gate is in motion, may be drained or vented to atmosphere when gate is open or closed. Integrity of seals can be checked any time by a tell-tale valve on the body.

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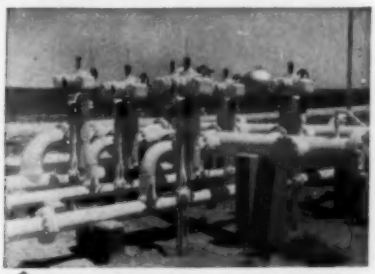
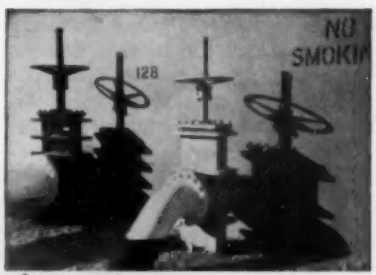


Products manifold at pipeline station illustrates typical motor-operated *Seal-O-Ring* Valve application.

LPG tank-to-pipeline is critical service where it's well to be able to check seal in the line—any time.



Self-cleaning feature is particularly important on crude oil tank lines.

GROVE SEAL-"O"-RING Gate Valves

SUBSIDIARY OF WALWORTH

GROVE VALVE and REGULATOR COMPANY • 6529 Hollis St., Oakland 8, Calif.
HOUSTON 23—3517 Polk Ave. • • • • • LOS ANGELES 6—1930 W. Olympic Blvd.

GROVE SEAL O RING GROVE SIMPLICITY ACCURACY SAFETY

ODESSA, TEXAS • TULSA, OKLAHOMA • CHICAGO, ILLINOIS • DENVER, COLORADO • In Western Canada: GROVE VALVE LIMITED, EDMONTON

Harry R. Kramp Is Boosted By Fred E. Cooper, Inc. . .

H. R. KRAMP

to be vice president and assistant general manager. J. W. Allen, president of the firm, in announcing the appointment, said that Kramp had been associated with Cooper for the past 24 years.

Following his completion of engineering studies, Kramp joined the fabricating and engineering departments of the Sand Springs Steel Co. Later he joined The Texas Co., working in the maintenance, operating, and engineering departments.

In 1934 he joined the sales department of Fred E. Cooper, Inc. His first job was driving the new-high speed winch tractor on demonstration tours. The first assigned sales territory for Kramp was in Oklahoma. Then he became southern division manager with the territory of Texas, New Mexico, Louisiana, Mississippi, and Arkansas, with division headquarters in Houston.

In 1956, Kramp was assigned to the home offices in Tulsa as vice president and assistant general manager.

Delta-Desco Co.'s Held Its Annual Sales Meeting . .

at the company's main office in Shreveport, La., recently. Attending were sales and service representatives from all over the nation.

The company's newest preventive maintenance item, the Delta valve-stem shield was demonstrated. Also demonstrated were new maintenance services including valve lapping and grinding service.

Malcolm B. Roach Is Named By Otis Engineering Corp. . .

to be general sales manager. Roach, prior to joining Otis, was president of Dewey Supply Co. in Tulsa. He was also regional sales manager for Dayton Rubber Co. in Dallas and Passaic, N. J.

Otis manufactures and markets a line of subsurface controls for oil and gas wells and also operates a large fleet of wire line service units in the petroleum industry.

D. D. Bovaird Presents Awards at Sales Meeting

Recognition was given to 41 of the firm's employes for 655 years of service to Bovaird Supply Co. Dr. Herbert True, assistant professor of marketing at Notre Dame University and consultant for General Electric, Transworld Airlines, Chicago Tribune, and National Management Association, was the principal speaker at the annual sales meeting held at Western Hills Lodge, Wagoner, Okla.

Other speakers were Davis D. Bovaird, president; William J. Bovaird, general manager of stores; Raymond E. Batchelor, vice president and sales manager; and Thomas H. Trower, secretary-treasurer. Roscoe G. Ayers, vice president and general manager, was master of ceremonies.

Here Dr. True emphasizes a selling point to Bovaird representatives from 28 offices and stores in Illinois, Kansas, Louisiana, New Mexico, Oklahoma, and Texas.

Magcobar Acquires Mud Supply Co., Inc.

Willard M. Johnson, president of Magnet Cove Barium Corp., explained that the newly acquired firm had been a Magcobar distributor in Louisiana headquartered at Lake Charles. The acquisition will enable Mud Supply to strengthen its ability to serve customers through expansion of their facilities and equipment. There will be no change in company policy or personnel, and I. W. Hoskins will continue as Mud Supply's president and general manager.

Rector Well Equipment Co. Names I. B. Allen to Post . .

I. B. ALLEN

as sales representative in Venezuela, according to Jerry Pinkard, Rector sales manager. Allen has been in Venezuela for the past 10 years and was formerly president of Peticon. Before joining Rector he was with Helmerich & Payne. Prior to going to Venezuela, Allen was a petroleum engineer with Pan-American Corp., working in Colorado, Oklahoma, and Wyoming.

Alco Products, Inc., Makes Ray Loesby Northwest Agent

Loesby, who owns Unit Process Co. of Kirkland, Wash., will handle finned-tube heat exchangers and immersion, tank suction, and line pressure heaters built by Alco. His territory will comprise Washington, Oregon, Idaho, and western Montana.

His appointment was announced by E. N. Sieder, marketing manager for Alco's petroleum industry equipment division.

Loesby's other clients include Keystone Valve Corp., Mission Manufacturing Co., Philadelphia Pump & Machinery Co., and Atlas Mineral Products Co.

Welex, Inc., Boosts H. K. McArthur to Key Post . .

as vice president and manager of the Texas Gulf Coast division. Division offices are in Houston.

The division includes district offices in Alice, Tex., with C. F. London in charge; Beaumont, Tex., with C. P.

THREADS LAST LONGER

with

IMPROVED

to meet the demands of faster, deeper, drilling

MONEY BACK GUARANTEE!

Sold through your favorite supply store

USE JIMMY GRAY DOPE BRUSHES

PETROLEUM DISTRIBUTING COMPANY

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HENRY H. PARIS DISTRIBUTOR, Inc.

OIL WELL, REFINERY AND INDUSTRIAL SUPPLIES

1125 ROTHWELL ST • P. O. BOX 932 • HOUSTON, TEXAS

Agent and Distributor for the Following Nationally Known Manufacturers:

ALTEN FOUNDRY & MACHINE WORKS
Lancaster, Ohio
Surface Equipment.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio
OIC Valves, Bronze, Iron, Cast, and Forged Steel for all purposes.

DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS.

THE GORMAN-RUPP COMPANY
Mansfield, Ohio
Centrifugal Pumps.

STEEL FORGINGS, INC.
Shreveport, La.
Weld Saddles.

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

LOS ANGELES BOILER WORKS, INC.
Los Angeles, Calif.
Welding Cups—Dished & Flanged Heads.

WESTERN SAFETY BARREL STAND
Houston, Texas
Stand lifts, holds, tilts 55 gal. barrels
Prevents Spillage—easily loaded.

MILLS IRON WORKS, INC
Los Angeles, Calif.
Seamless Swage Nipples, Bull Plugs & Welding Reducers.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

Engelke as manager; Corpus Christi, Tex., with C. E. Jacobs as manager; Falfurrias, Tex., with G. F. McLaughlin as manager; Houston with W. R. Marshall as manager; Liberty, Tex., with M. F. Arnold as manager; Mission, Tex., with R. R. Nance as manager; and Victoria, Tex., with W. E. Wallace as manager.

Other division personnel include J. J. Blaydes, assistant division manager; J. W. Lyon and H. A. Woodard, division sales managers; and W. O. Foerster, division sales engineer. E. R. Sanders, division sales engineer, has offices in San Antonio.

J&L Is Kansas Agent for Gardner-Denver Pump Parts

Jones & Laughlin Supply Division was recently appointed codistributor of Gardner-Denver mud pumps and will eventually become exclusive parts distributor for the United States and Canada, with the exception of California which is outside of J&L's area of operations.

According to W. L. Wolfe, plans have now been completed to stock mud pump replacement parts at all of 85 stores operated by J&L. Transfer of the parts will continue in other regions of the United States and Canada as additional storage facilities are added.

In Kansas, J&L operates supply stores at Chase, El Dorado, Great Bend, Hill City, Liberal, McPherson, Russell, and Winfield. District sales headquarters are at Wichita under the direction of J. A. Carrigan, district sales manager.

Dow Chemical Co. Opens New Dallas Sales Office . .

with Donald P. Camp, former head of chemicals sales at the Houston office, named as manager.

The new office will handle all Dow major product lines, industrial and agricultural chemicals, plastics, and magnesium in a territory which includes the north half of Texas, all of Oklahoma, and southwestern New Mexico.

EQUIPMENT with Engineering SERVICE

METER RUNS

MECO Standard Meter Runs conforming to A.G.A. specifications are made in our own fabricating shop of materials carried in stock. —Seamless steel pipe, Tube Turn welding fittings, Forged steel flanges, and Commercial Orifice fittings. Meter Runs are available bored and honed, coated bore for corrosive service, and to special designs.

Ask for Bulletin No. P-100

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MAINTENANCE Mechanical CORPORATION
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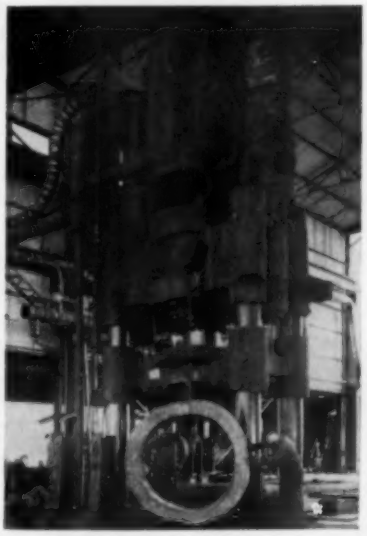


Gulf Forge Co. Installs This 2,000 Ton Press . .

at its Houston plant to handle forgings much too large for its former equipment. Because the press was built by Mesta Machine Co. crewmen at Gulf Forge have nicknamed the enormous press "Big Pearl."

Until the installation of this new press, manufacturers in the Southwest have had the choice of purchasing large forgings in the East, or of substituting castings or weldments for their requirements.

Big Pearl had been in service at the Naval Gun Factory at Washington, D. C. It took 120 days to disassemble the equipment and seven flat cars to take it to a port at Edgewater, N. J. The press was seatrained to Texas City, Tex., except for the gigantic base, weighing 153,000 lb. which was routed by rail to Houston.

Big Pearl can exert 4 million pounds of pressure and can reduce 10-ton ingots to billets, shafts, and other shapes.

Bank of Texas Buys Share In Esperson Buildings . .

and establishes its permanent home in the Niels Esperson Building. After 1 year of business, the bank deposits more than doubled, and the bank bought an undivided half interest in the Niels and Mellie Esperson buildings. The financing is so arranged that under present operating revenues and expenses the entire investment of the bank can be written off in 10 years.

Under President Leslie Coleman, who had been vice president in charge of the southwest, southeast, and the far western division for the Chase Manhattan Bank in New York, deposits increased 141.4 per cent.

Acquisition of the Esperson buildings was negotiated and planned by George A. Butler, vice chairman of the board of directors; Jack Binion, a director, and George Rice, their partner in the law firm of Butler, Binion, Rice & Cook.

Coleman and Masquelette discuss acquisition of Esperson buildings.

Mrs. Oveta Culp Hobby, president of the Houston Post Co., is chairman of the board. Recent appointments include those of Philip A. Masquelette as vice president, and Robert L. West as vice president in charge of general credits.

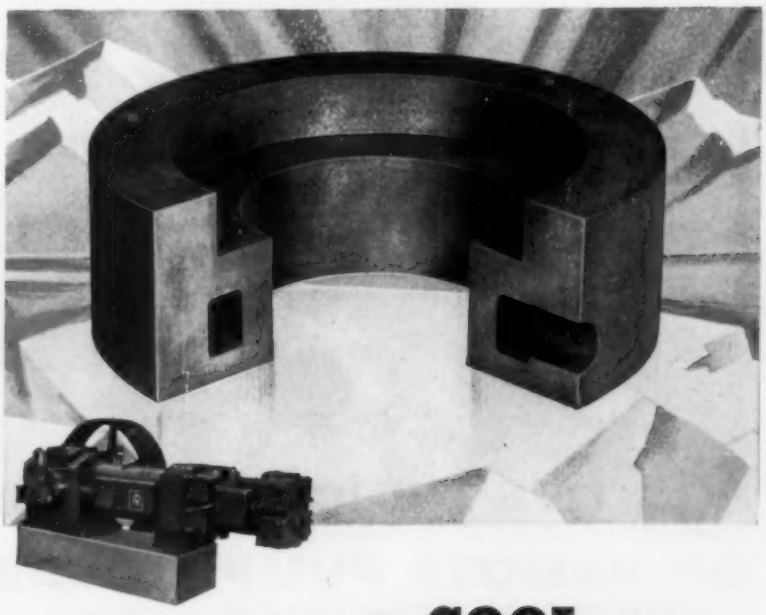
Directors of the bank including members of the advisory board are: Paul F. Barnhart, petroleum engineer and independent oil operator; Frank W. Bellows, Trinity Construction Co.; Jack Binion and George A. Butler; J. R. Butler, Butler, Miller & Lents; H. Merlyn Christie, Christie, Mitchell & Mitchell; Coleman; Denton A. Cooley, M.D.; William G. Farrington, Tanglewood Corp.; N. W. Freeman, Tennessee Gas Transmission Co.; Elmer C. Gardner, Elmer C. Gardner, Inc.; Michel T. Halbouty, independent producer and operator; Dan J. Harrison, independent oil operator; Oveta Culp Hobby; L. H. Juengling, Sheffield Division, Armco Steel Corp.; Alwyn P. King, Jr., King & Heyne; Ed T. Malloy, Levingston Shipbuilding Co.; Harris Masterson, independent oil operator; R. Thomas McDermott, J. Ray McDermott & Co., Inc.; M. E. Montrose, Hughes Tool Co.; George Peterkin, Jr., Dixie Carriers, Inc.; Stanley W. Shipnes, Sears, Roebuck & Co.; Henry O. Weaver, Western Natural Gas Co.; John H. Wimberly, Houston Natural Gas Corp.; Allen H. Carruth, partner in John L. Worthan & Son, Insurance; John C. Flanagan, vice president of United Gas Corp.; T. P. Hull, Jr., vice president of J. Weingarten, Inc.; Masquelette; James Noel, attorney; Arthur J. Palmer, executive vice president, Ada Oil Co.; Allen F. Rhodes, director of engineering, McEvoy Co.; P. R. Rutherford, Jr., oil operator, and C. J. Thibodeaux, marine broker.

H. K. Porter Co., Inc. Names Sales Vice President

Burton Schellenbach has been appointed to the post, according to C. L. Holbert, Porter's president. He will make his headquarters in the company's Pittsburgh office.

Schellenbach joined Porter from the Cleveland office of Fuller & Smith & Ross, Inc., where for 12

Look to **COOK** for Better Packings!



Keep your packing COOL with this leak-proof Cook packing cup!

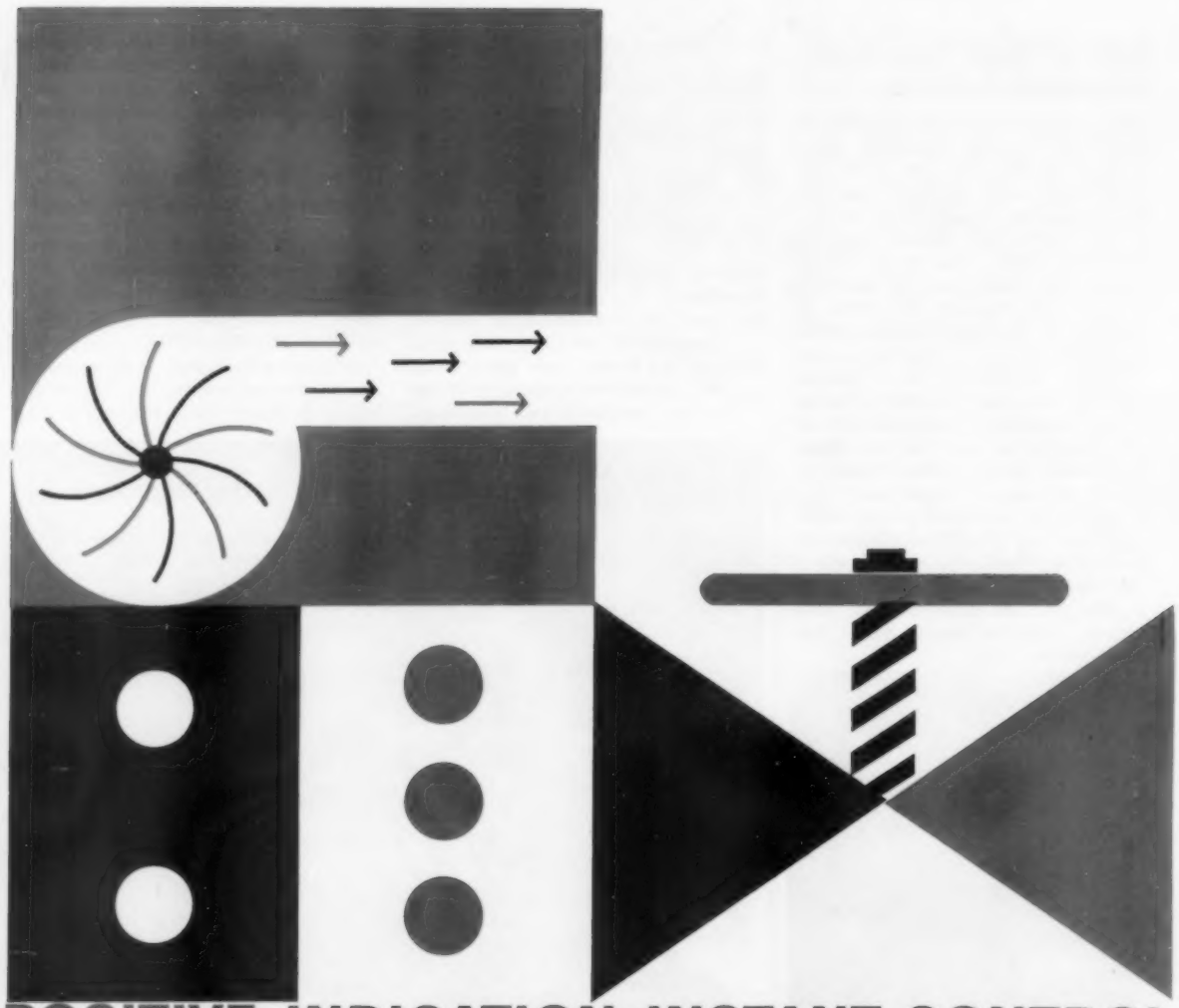
CHANCES are you've never seen anything like Cook's water-cooled packing cup, as shown above with one of Ingersoll-Rand's new ESH compressors. That's because it's new, *with a leak-proof construction that's exclusive with Cook!*

Water circulates around the *inside of the cup itself,* in a completely self-contained channel. This eliminates any possibility of leakage, corrosion, or contamination of the material under compression. These are big advantages for all applications—and are of even *greater* importance for non-lubricated service.

Write for full details about this revolutionary new water-cooled packing cup. Address: C. Lee Cook Company, 934 South Eighth Street, Louisville, Kentucky.

C. LEE COOK COMPANY
Division of Dover Corporation

Rings and Packings Since 1888



POSITIVE INDICATION-INSTANT CONTROL OF REMOTE PUMP MOTORS AND VALVES

S&J Gardtrol units continuously report actual conditions at remote points. They also allow instant change of conditions by the operator. Gardtrol Valve Monitor shows open, opening, closing, closed or stopped (partly closed) conditions. Gardtrol Pump Motor Monitor indicates on or off. Both have simple illuminated push button controls for all functions. Only one small wire—plus a common return—is needed between control unit and the field unit. S&J Gardtrol assures reliable supervisory control at lowest cost.

SHAND AND JURS GPE

SHAND AND JURS COMPANY 2600 Eighth Street, Berkeley, California

years he was successively: vice president in charge of the agency's marketing and advertising efforts for Aluminum Co. of America, then director of marketing and chairman of the plans board for the agency's Cleveland operation. He also was a member of their board of directors.

Ideco, Inc., Appoints Three Technical Representatives

B. L. PRICE

E. F. Shiels, vice president, said that Berwin L. Price has been transferred from the sales department in Dallas to Beaumont, Tex., where he will represent Ideco in the Gulf Coast area. Charles W. Harrison has joined the company at the Houston office, and will also work in the Gulf Coast area. On the West Coast, Shannon L. Matheny, Jr. has been added to the California sales group and will headquarter at the Long Beach office.

C. W. HARRISON

S. L. MATHENY

Price, who joined Ideco in 1952, has worked in the proposal department and export sales. Harrison had prior sales experience with Parkersburg Rig & Reel Co. and Ingalls Shipbuilding Corp. Matheny was formerly with Standard Vacuum in Indonesia and Continental Oil Co. in California.

Alberta Phoenix Ready to Produce 16-In. Pipe . .

according to a recent announcement. The company has completed alterations and tooling of the mill and has scheduled the first rolling for March. New additions required an investment of approximately $250,000. Inclusion of this larger pipe in the mill's range placed Alberta Phoenix in a position to supply practically all sizes used in western Canada.

The company, operating since September 1956, can produce tubular products at the rate of more than 150,000 tons per year. All pipe and casing is manufactured to API specifications.

Lufkin Foundry & Machine Co. Conference Held . .

at the home office plant recently for oil field sales personnel. More than 40 sales representatives were in Lufkin, Tex., for the 4-day conference.

L. A. Little, vice president of the company, opened the conference. Sales representatives who attended the meeting were: V. J. Fawcete, Robert Spaulding, Al McConville, W. G. Corey, R. D. Dunlop, Jack Gissler, A. E. Careway, R. C. Thompson, Jim Roe, T. A. Banta, W. T. Crowder, Vernon Glenn, Elvin Read, A. G. Black, Henry Burnett, George Henson, Jim Brown, Marion Hightower, Robert Gibbs, Ernest Slaughter, Howard Hogue, A. V. Simonson, John Swanson, Jack Jumper, W. H. Miner, T. L. Bower, Milton Kramer, Val Gallia, Joe Randol, B. C. Burnette, A. L. Christina, G. W. Nichols, Oliver McKay, Charles Dyer, John D. Mettauer, Newell Lynch, D. A. Reid, H. H. Muller, L. W. Breeden, Ben Sargent, Don Bowcutt, Roy Little, Gene Nixon, Gene Towle and E. E. Johnson.

Local plant personnel who attended were: Walter W. Trout, E. P. Trout, A. E. Cudlipp, C. D. Richards, C. M. Wooten, G. L. Vickery, J. T. Hood,

now!

IMMEDIATE DELIVERY

ON MANY TYPES AND SIZES OF

MAXIM SILENCERS

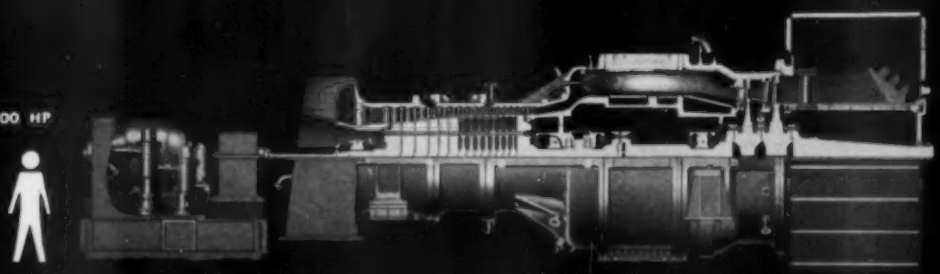
Need silencers on short notice? Contact Maxim. We are now stocking an increasing number of the more widely used types and sizes. As a result, we may be able to give you immediate delivery.

If the type and size you need is not in stock, you can still depend upon Maxim to give you best delivery — from the *most complete line of industrial silencers.* Equally important, you can count upon outstanding performance — in the tradition that has made Maxim the preferred silencer throughout industry. Maxim, more than ever, stands for special customer service.

THE MAXIM SILENCER COMPANY

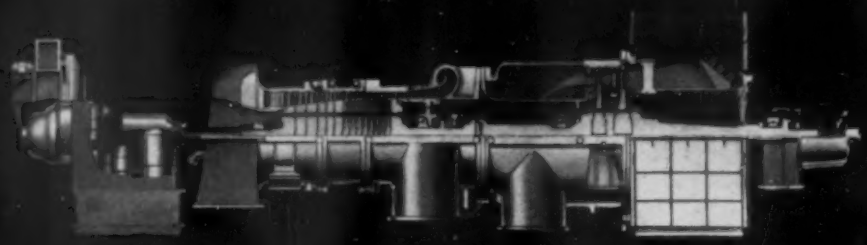
Subsidiary of Emhart Manufacturing Company

88 HOMESTEAD AVENUE • HARTFORD, CONN.

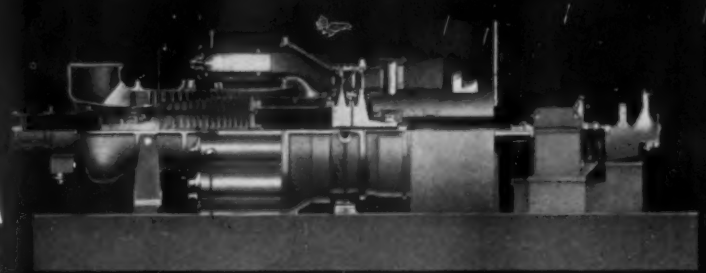


SIMPLE-CYCLE
16,500 KW, 22,500 HP

General Electric Gas Turbines Log...



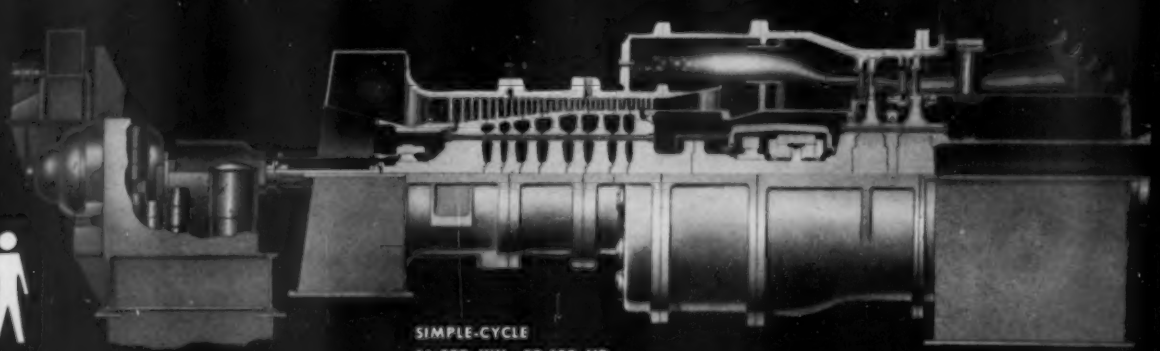
REGENERATIVE-CYCLE
15,200 KW; 20,900 HP



SIMPLE-CYCLE
9,500 KW; 13,400 HP

REGENERATIVE-CYCLE
5,400 KW; 7,600 HP

SIMPLE-CYCLE
5,300 KW; 7,500 HP



SIMPLE-CYCLE
21,800 KW; 30,400 HP

OPERATING EXPERIENCE, WIDE RANGE OF RATINGS OFFER NEW OPPORTUNITIES FOR INCREASING USE

Over 2,250,000 Operating Hours

Over two-and-a-quarter-million operating hours recorded by 135 units in a wide variety of applications—this is the unduplicated performance record that has established General Electric gas turbines as increasingly important powermakers.

APPLICATION VERSATILITY is one of the primary reasons for wide gas turbine acceptance. By providing power, exhaust heat, or combustion air for use in process or in combination with steam turbines, these self-contained prime movers are able to satisfy a variety of power requirements. A brief look at the chart on this page shows the varied industries using General Electric gas turbines.

A BROAD RANGE OF RATINGS is now available. Units range from 6,700 to 30,400 horsepower and 4,750 to 21,800 kilowatts. Because gas turbines are more compact than conventional power plants, building requirements are simple and limited space is required.

Proven by operating experience, versatile General Electric gas turbines stand ready—now—for even broader application. Whatever your power, heat or process requirements are, why not get all the facts on this important power plant. For more information, contact your nearest General Electric Apparatus Sales Office or write for GED-3546 (Gas Turbines for Industry), or GED-3603 (Gas Turbines for Electric Utilities), General Electric Company, Section 261-31, Schenectady 5, N. Y.

GENERAL ELECTRIC GAS TURBINES POST IMPRESSIVE OPERATING RECORDS IN DIVERSE APPLICATIONS

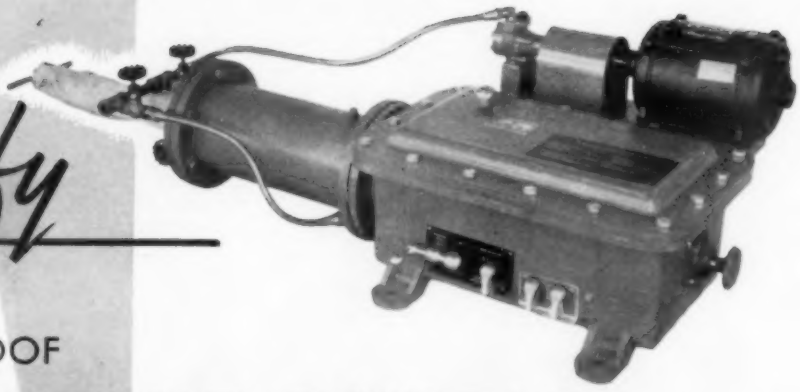
APPLICATIONS	NUMBER OF UNITS*	TOTAL EQUIVALENT HORSEPOWER*	OPERATING HOURS
GAS AND OIL PIPELINE	88	574,800	1,185,000
LOCOMOTIVE DRIVE	58	462,890	500,000
ELECTRIC UTILITY	31	348,200	200,000
PETROLEUM AND CHEMICAL	20	191,450	50,000
OIL FIELD	16	155,400	300,000
GENERAL INDUSTRIAL (steel, rubber, paper)	5	76,200	10,000
MARINE AND NAVY	2	10,600	5,000
TOTAL	220	1,819,540	2,250,000

*General Electric gas turbines installed and on order as of February, 1958.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Specify



THE *NELSON*
EXPLOSION-PROOF

PIPE LINE SAMPLER.....

Designed to meet a real need, the Nelson Pipe Line Sampler takes small representative samples of crude oil or refined products that are flowing in a pipe line.

(1) Fulfills A.P.I. requirement of draining sample line before taking a sample.
(2) Operates from contact on a flow meter or by built-in period timer.
(3) Takes continuous sample in small increments.
(4) Takes and holds sample from line under line pressure.
(5) Rugged, explosion-proof construction throughout.

WRITE FOR ILLUSTRATED 7-PAGE BULLETIN . . .

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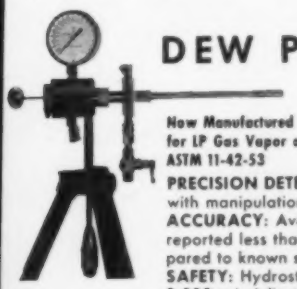


DEW POINT TESTERS

ASTM-D 1142-53

Now Manufactured In Two Models For LP Gas and Natural Gas. 0-1000 psi for LP Gas Vapor and Natural Gas. Model also available in 0-3000 psi. ASTM 11-42-53

PRECISION DETERMINATIONS: Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2° F.
ACCURACY: Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
SAFETY: Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.

DEW POINT RECORDER

BUREAU OF MINES TYPE

RECORDS DEW POINT OF GASES UNDER PRESSURE

SUITABILITY: For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
CONTINUOUS RECORD: of dew point gas.
RAPID RESPONSE: To changing dew point of gas.
RELIABLE RESULTS: Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines. This instrument records dew point of a continuous sample of natural gas at line pressure up to 3,000 psi.

REFINERY SUPPLY COMPANY

REFINERY SUPPLY COMPANY

J. B. Hopper, Louis Fincher, Guy Croom, R. E. Barr, Robert Lang, C. O. Watts, Dan Martin, M. L. Wailkinson, F. C. Hays, Hubert Dyer, W. A. Kirkland, Ben Elliott, R. L. Poland, Gene Tate, Fred Griffin, T. D. Lashley, R. M. Rosser, C. J. Schuller, C. W. Alexander, Frank Stevenson, John Fincher, Dave Bishop, Bryan McCarty, Sam Curtis and Bob Bruce.

Tube-Kote, Inc., Appoints John Gilbert to Houston . .

to be sales representative for the tubular sales division. Gilbert has had 6 years experience in corrosion control. He will sell and service tubular plastic coatings for oil field tubing and drill pipe.

W. H. Shenkle Made General Mgr., Instrument Division . .

W. H. SHENKLE

at Rockwell Manufacturing Co.'s Tulsa plant. The announcement came from Lloyd A. Dixon, Jr., vice president in charge of the parent meter and valve division. Shenkle joined Rockwell in 1953 as product engineer at the Tulsa instrument plant. Until this recent appointment, he had served as chief engineer of the instrument division.

Oilwell Makes Changes In Canadian Area . .

The following shifts were made by W. A. Weir, Canadian area manager for the Oil Well Supply Division of U. S. Steel. Joseph L. Devlin has been named district representative at Calgary, Alta. Christopher H. Marshall, field representative at Estevan, Sask., has been transferred to Valley View, Alta. James A. Groves has been made city representative at Calgary, and William R. Miller has been appointed as area office manager at Calgary.

Devlin was employed by Oilwell in 1951 at Edmonton, Alta., as field engineer. In 1952 he was appointed assistant district engineer and was transferred to Calgary. The next year he was transferred to Okotoks, Alta., and thereafter served the division at Red Deer, Alta., and in Okotoks prior to being trnasferred back to Calgary in October 1957.

Marshall joined Oilwell at Virden, Man., in 1955 and was transferred to

ASME Code
National Board Inspection
Pressure Vessel
Fabrication
Carbon Steel
Alloys
Alloy Clad
ROLLING CAPACITY
4" thick

BROCHURES WILL BE MAILED UPON REQUEST

GENERAL
WELDING WORKS, INC., HOUSTON
P. O. BOX 10197
HOUSTON 18, TEXAS
UNderwood 9-1458

STEP SAVER
starts and stops electric motors automatically.

This 6¼" x 8" x 3" metal box is a MURPHY Transformer-Relay Assembly. Used with the proper MURPHY Safety Switch, it can stop, start or reverse your electric motors by radio control, or upon change in time, tank level, line pressure, or temperature.

It controls up to 440V with a safe 24V grounded circuit — can sound and flash alarms when things go wrong and immediately shut down equipment before damage.

Will pay for itself within 4 months if it can save you only 30 minutes a day in labor. Will pay for itself in 30 seconds if it saves a piece of your equipment. It's the EYE that never blinks.

Write for details, prices or engineering help. Ask for Bulletin TR-1.

FRANK W. MURPHY MANUFACTURER, INC.
RANCH ACRES STATION
TULSA, OKLAHOMA
MURPHY SAFETY SWITCH OF CALIFORNIA
11812 Davenport Road • Los Alamitos, Calif.

MAP FILE

#MT4

Easiest way to file and find confidential maps, tracings, blueprints. Quality metal cabinet file with locking doors. 112 tilting tubes handle 60" prints. Tubes indexed for quick location. Ideal for field and home offices. Shipped from stock.

Patent No. 1610368. Other Patents Pending.

SCOTT-RICE CO., 610 S. Main, Tulsa 3, Okla.

LAWSON Santa Gertrudis RANCH . . . Warner, Okla.

BULLS AND HEIFERS FOR SALE

All of our herd bulls are "Running W" King Ranch bulls.
All of our herd cows are Richard King cows.

4 miles east of Warner on U. S. 64 . . . "Where champions are raised"
Phone Owen Lawson RI 2-1454, Tulsa or Ralph Johnson HO 3-3545, Warner

Member of Oklahoma Santa Gertrudis and Santa Gertrudis Breeders International

Here's the kind of service you get . . .

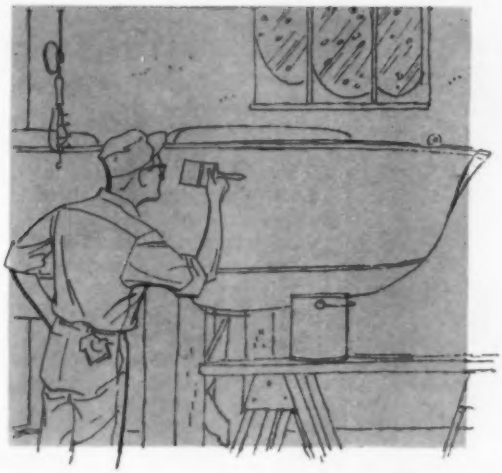
with HONEYWELL instrumentation

Bill Lewis, typical service engineer, proves how you can depend on Honeywell for fast, on-the-spot service even in emergencies.

3 It took Bill two hours to drive to the plant through the storm. He spotted the trouble immediately; a thermocouple and its protecting tube had burned out. It might have meant four to five thousand dollars' worth of damage.

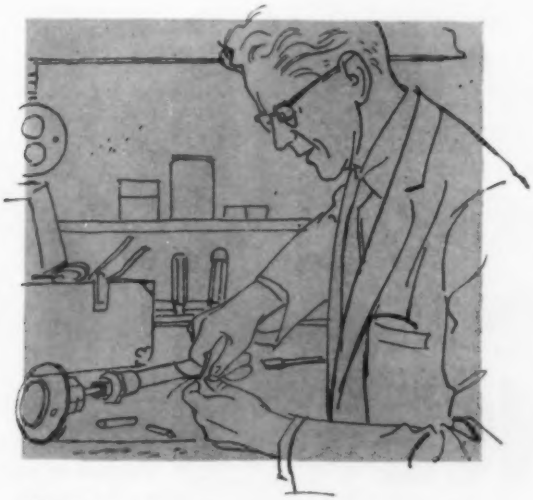
Honeywell service begins when you first decide you need instruments, and continues long after they're installed. It includes:

- Preliminary engineering, even before specifications are written.
- Application engineering for installation and startup.
- Service engineering help from your nearby Honeywell branch.
- Periodic service and swift help in emergencies.
- Training of your operators at the Honeywell Instrumentation Education Center.



1 Bill Lewis, service engineer at Honeywell's Fort Wayne branch, was in his garage, touching up the paint on his 13-foot outboard. The bowling match had been called off that night because of the snowstorm, and Bill was glad to be home.

2 At 9:30 a call came from the Crosby Laughlin Division of American Hoist and Derrick Company in Fort Wayne. A controller on a galvanizing kettle wasn't working and unless it was fixed fast, the pot would either freeze or burn out. Bill said he would be out right away.



4 Bill didn't have a thermocouple with him that would fit, so he improvised a temporary couple and protecting tube and got the system going. Early the next morning he called the Honeywell branch in Indianapolis and had the correct thermocouple and tube shipped quickly to the plant. Next day, he carefully checked out the entire installation.

5 Now, Crosby Laughlin Division is signed up with the Honeywell Periodic Service Plan, and its complete instrumentation is checked and serviced every month. Any spare parts needed are now available at Honeywell's Fort Wayne branch. Bill hasn't had to make another emergency call to the plant since.

Around-the-clock help in emergencies is but one of many Honeywell services that give you extra value for your investment in instruments. Get the complete service story from your nearby Honeywell field engineer. He's as near as your phone.

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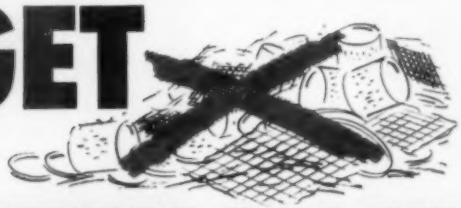

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Drayton Valley, Alta., in 1956. He was named field representative at Estevan in 1957.

Groves came to Oilwell in 1948 at Houston. He entered the U. S. Air Force in 1950, returning in 1954 to Swift Current, Sask., where he was appointed field representative in 1955. Since then Groves has been employed as field representative at Drayton Valley, Valley View and Estevan.

Miller was employed by Oilwell in 1952 at Odessa, Tex., and was named field representative there in 1954. Prior to his present appointment he was store supervisor at Odessa.

W. S. Johnson Is Manager Of Oil Field Division . .

W. S. JOHNSON

for Fairbanks, Morse & Co. The announcement came from V. H. Peterson, vice president, sales, who also announced the retirement of Harry J. Renken from the same position. Johnson was manager of the diesel department of the Dallas, Tex. branch. Renken came to Fairbanks-Morse in 1915. He had also been manager of the company's Dallas branch.

J. V. Pennington Made Vice Prexy By Globe Oil Tools . .

PENNINGTON

and will also act in the capacity of general manager, according to Mrs. H. R. Whittaker, president of the California company.

Pennington, after his first engineering assignments on the East Coast, went to Houston where he was introduced to the rock bit business, serving for 13 years with one manufacturer in capacities as works manager, research director, and vice president in charge of manufacturing and engineering.

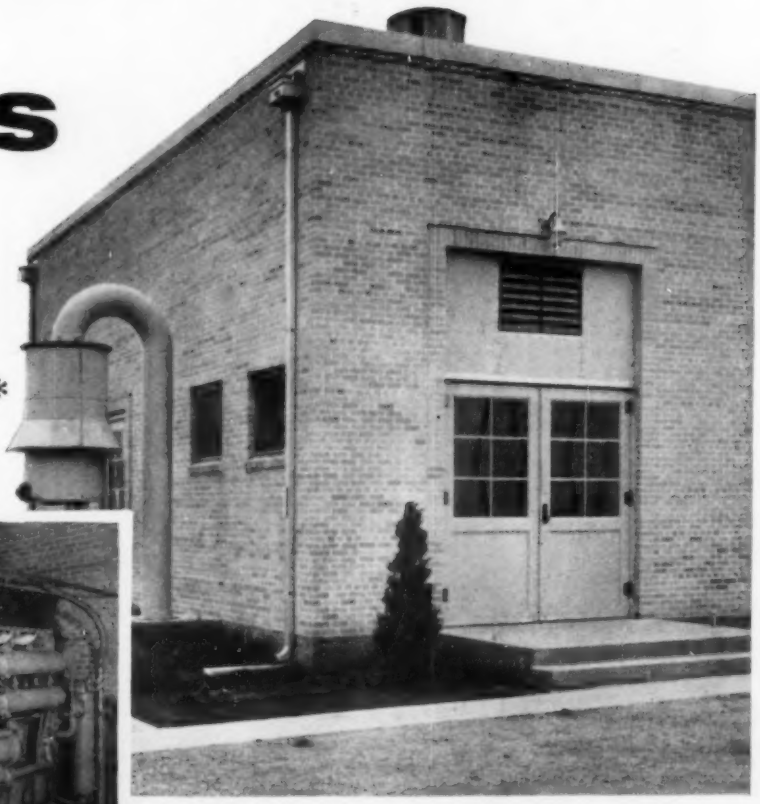
Pike, Chumbley, MacDonald Appointed by Tube Turns . .

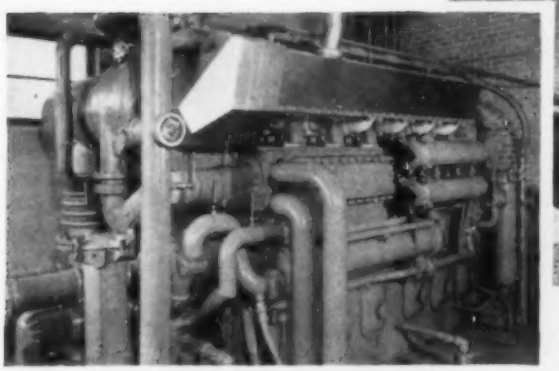
as division vice presidents and as controller, respectively. John G. Seiler, Tube Turns president, said that John E. Chumbley will be in charge of general sales operations and Thomas H. Pike will be in charge of planning.

Chumbley, with the firm since 1937, became manager of flange sales

IN UNATTENDED AUTOMATIC STATIONS . . .

You can forget about dirty air when CYCOILS are on the job! . . . . . *





* An AAF Type W Cycoil protects the air intake for the 800 hp. Alco diesel engine at this unattended pumping station of Great Lakes Pipe Line Company near Topeka, Kansas.

Automatic pumping stations, which are completely unattended, are becoming more and more common in the petroleum industry. Here, too, AAF intake filters are on the job helping keep the wheels of automation in operation.

All equipment for these stations is selected on the basis of continuous, round-the-clock service, with an absolute minimum of maintenance. AAF Cycoil oil bath filters clean intake air—protect the valuable engines, which are the heart of the system.

Cycoils do their job with practically no maintenance. Every Cycoil is automatically self-cleaning—with no moving parts. The only maintenance necessary is the periodic removal of sludge from oil reservoir.

Whether your operation is automatic or not, you need this same type of positive protection. And—whatever your need in clean intake air, AAF has the right filter—engineered to save you maintenance dollars. Write today for bulletins, containing full information.

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American Air Filter of Canada, Ltd., Montreal, P. Q.

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NORDBERG

MEMO TO: Management
After investigation and full consideration of all facts this committee recommends the installation of Nordberg engines for this pipeline project.

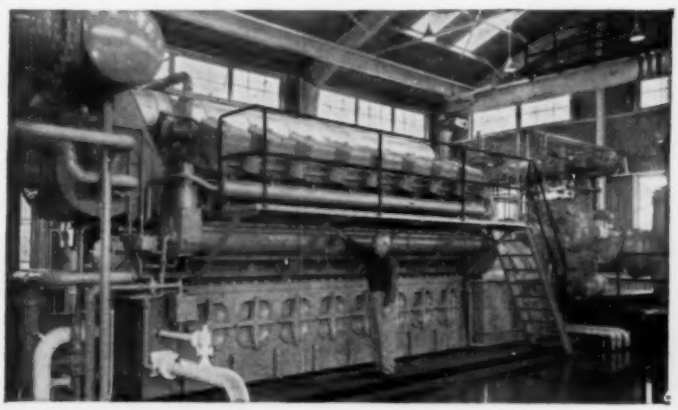
Chairman, Technical Committee

The Scene: Office of the Vice President in Charge of Operations, major gas transmission company.

The Problem: Selection of engine compressor units for gas pipeline expansion.

Recommendation: Install Nordberg *Supairthermal*® gas engine gear sets driving centrifugal gas compressors.

The Reason: Because the Nordberg units can be installed with lower capital investment, and operated at lower cost per horsepower-hour.



Nordberg Supairthermal Engines are, by all standards, your best investment in modern prime movers for compact, economical, long term pipeline power. These powerful engines are built in both In-line and V-types, in sizes from 500 to 4,500 horsepower for Diesel, Duafuel® or Spark-Ignition Gas operation.

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Models also available with separate Alarm Signal for each Beacon Lamp.

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BURBANK, CALIF.

in 1940, forging division sales manager in 1945, and assistant general sales manager in 1953.

Pike joined the firm as West Coast district manager at Los Angeles in 1940. He became assistant sales manager at the main office in Louisville, Ky., in 1945, was promoted to assistant general sales manager in 1953, and to merchandising manager in 1955.

F. E. MacDonald joined Tube Turns in 1937 and became assistant controller in 1945. He is also assistant secretary and assistant treasurer of National Cylinder Gas Co.

Ruska Instruments Effects Reorganization Plan . .

through a stock purchase by a group of Houston businessmen and election of a new board of directors, according to Walter Ruska, president.

Ruska manufactures and distributes a variety of instruments for the oil industry, in addition to geomagnetic prospecting equipment and observatory instruments. Headquarters are in Houston.

New directors, all of whom recently acquired an interest in the company, are J. Q. Weatherly, attorney who was formerly associate general counsel for Humble Oil & Refining Co.; W. T. Campbell, who has varied business interests in this area; David Frame, Sr., and David Frame, Jr., both oil operators. All are from Houston.

Ruska, the company organizer, retained his original interest and is the largest single stock owner.

Officers other than Ruska are C. D. Varner, vice president; S. H. Buckley, vice president, and M. M. Lignoul, secretary-treasurer. Varner and Buckley also are directors.

R. G. LeTourneau Receives Coveted Beaver Award . .

at the third annual awards dinner of The Beavers in Los Angeles.

Making the presentation to LeTourneau, president of LeTourneau, Inc., is George H. Atkinson, president of The Beavers and also president of Guy F. Atkinson Co. of San Francisco. Looking on at center is John M. Sawyer, chairman of the program committee and president of Macco Corp. at Paramount, Calif.

O. L. Lewis Has Joined Ehrhart & Associates, Inc. . .

as chief engineer, in charge of the engineering department in both the Los Angeles and San Francisco offices.

He comes to E & A from C. F. Braun & Co., with approximately 20 years of engineering design and construction experience on process units for the oil and chemical industry.

Grant Oil Tool Co. Moves To New Office and Plant

According to A. H. Salvatori, vice president of the Los Angeles firm, the new facilities cover 20,000 sq. ft. The modern plant will allow handling of the increased demand for Grant tools, will play an important part in equipment research, and in production of the newly acquired line of Zublin tools.

Onan ELECTRIC PLANTS
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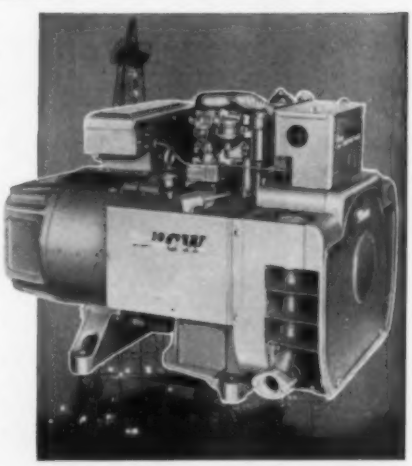
Onan ELECTRIC PLANTS

10KW lightweight "CW" electric plant has multiple uses

Mobility makes it jack of all trades on job sites; also dependable standby unit

In exploration, drilling, pipeline construction and operation, the Onan "CW" does more jobs—better. Weighs hundreds of pounds less than water-cooled units of similar capacity but outlasts so-called "heavy duty" electric plants. Powered by smooth-running, two-cylinder opposed, Onan gasoline engine. Equipped with exclusive Onan Vacu-Flo cooling for enclosed installations. All-climate Onan generator, direct-connected. Skid mounting and 2-wheel weatherproof trailer available.



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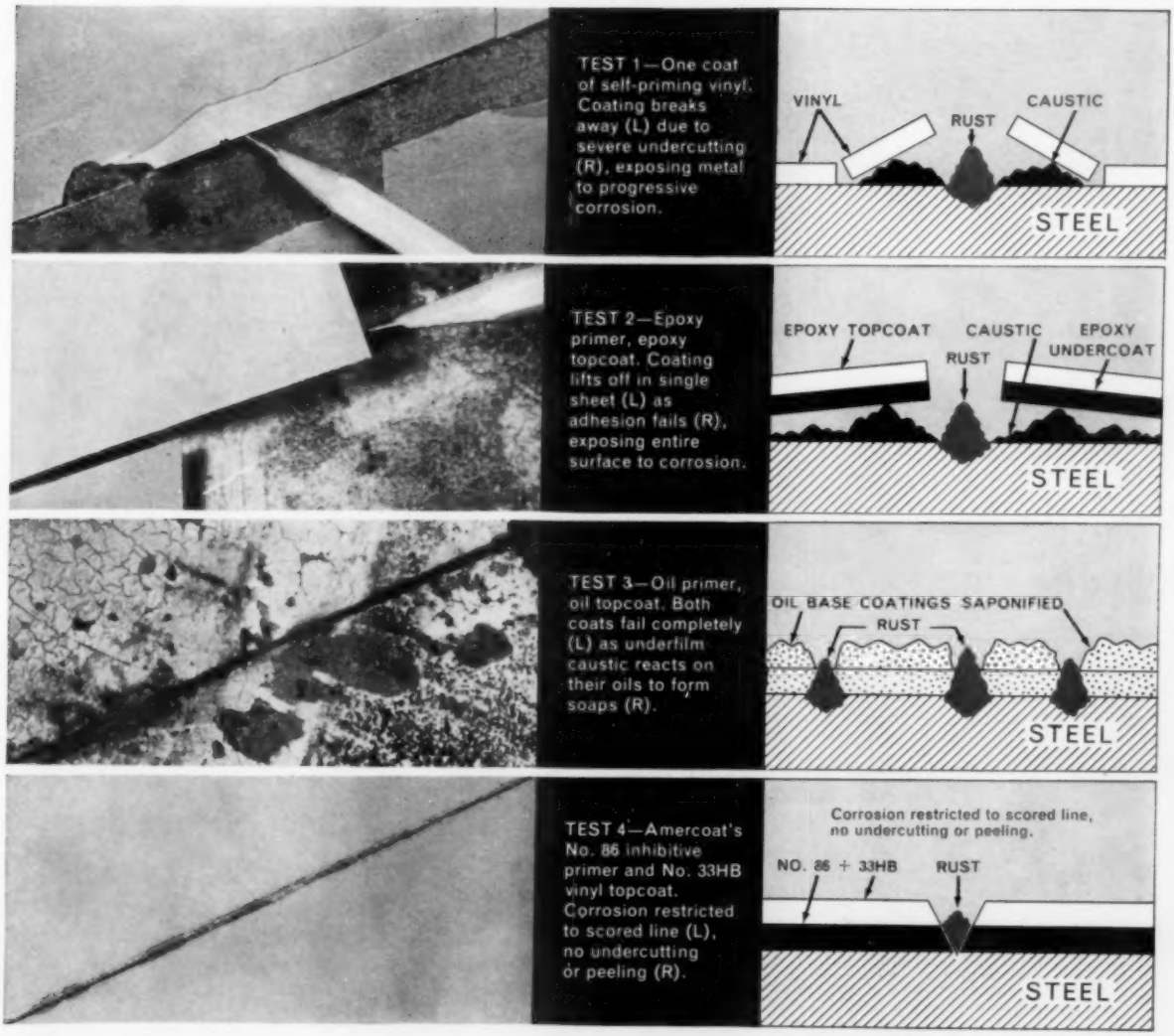
PUZZLED ABOUT PRIMERS?

Here are tests you can duplicate


TEST 1—One coat of self-priming vinyl. Coating breaks away (L) due to severe undercutting (R), exposing metal to progressive corrosion.
VINYL
RUST
CAUSTIC
STEEL
TEST 2—Epoxy primer, epoxy topcoat. Coating lifts off in single sheet (L) as adhesion fails (R), exposing entire surface to corrosion.
EPOXY TOPCOAT
CAUSTIC
RUST
EPOXY UNDERCOAT
STEEL
TEST 3—Oil primer, oil topcoat. Both coats fail completely (L) as underfilm caustic reacts on their oils to form soaps (R).
OIL BASE COATINGS SAPONIFIED
RUST
STEEL
TEST 4—Amercoat's No. 86 inhibitive primer and No. 33HB vinyl topcoat. Corrosion restricted to scored line (L), no undercutting or peeling (R).
Corrosion restricted to scored line, no undercutting or peeling.
NO. 86 + 33HB
RUST
STEEL

The purpose of these accelerated tests is to show what happens when various types of coatings are exposed to a typical corrosive environment. Four clean steel panels, free from mill scale and rust, were coated with different combinations of primers and topcoats. Each was scribed to bare metal and immersed in salt water in the presence of free oxygen, for two weeks.

As caustic deposits formed over cathodic areas of the steel in tests 1, 2 and 3, failure occurred in three ways. The vinyl, though not directly attacked, was undercut as caustic spread beneath the film and destroyed adhesion. The epoxy coating, known for critical adhesion to smooth metal, proved impervious to caustic attack. It was, however, lifted in its entirety as moisture spread beneath the surface. The entire oil paint film was quickly penetrated by the salt solution, creating widespread corrosion and caustic formation. The caustic then reacted with the oil to saponify the film.

In the fourth test the corrosion was limited to the score mark. Reason: Amercoat No. 86 Primer resists undercutting and adheres tenaciously, inhibiting electrolytic corrosive action.

The conclusions are clear. To provide long term protection in corrosive service, start with Amercoat No. 86 Primer, which provides a sound and lasting base for quality topcoats such as Amercoat No. 33HB.

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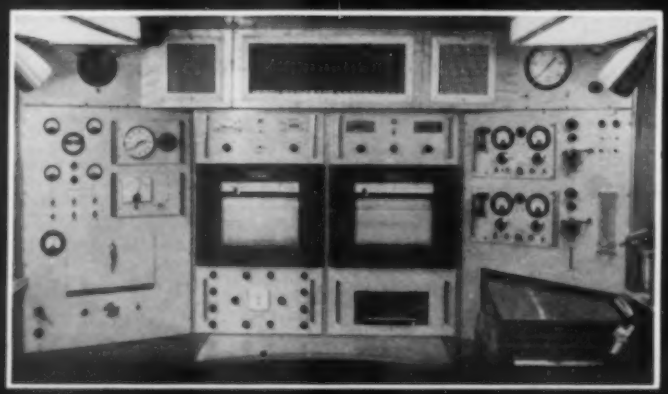
"TWO-STAGE" well logging . . .



START WITH CORE LAB'S UP-TO-DATE LOGGING EQUIPMENT . . .

ADD A MASS-SPECTROMETER OR INFRA-RED & CHROMATOGRAPH SYSTEM WHEN YOU NEED IT!

Core Lab announces the development of Well Logging units to afford convenient, rig-side installation of a *mass-spectrometer* or *infra-red-and-chromatograph system* — when it is needed.

For example, you can begin well logging operations with Core Lab's modern equipment — including a new hypersensitive gas trap, improved gas detector circuits, pump-rate meter, mud pit level instrument, TD and off-bottom counters, and weight-on-bit recorder.

When you reach greater depths and begin to penetrate more complex, more potentially productive zones, a compact, unitized electronic system can be added to the same field unit — and operated by the same crew.

With the addition of spectrographic or chromatographic equipment for continuous monitoring and identification of minutest quantities of mud-stream gas, the entire concept of well logging is advanced to the status of a super-tool in the search for oil.

And with Core Lab's *flexible*, two-stage arrangement, you can give your wildcat *all* the breaks — more economically. Next time, let Core Lab log it.

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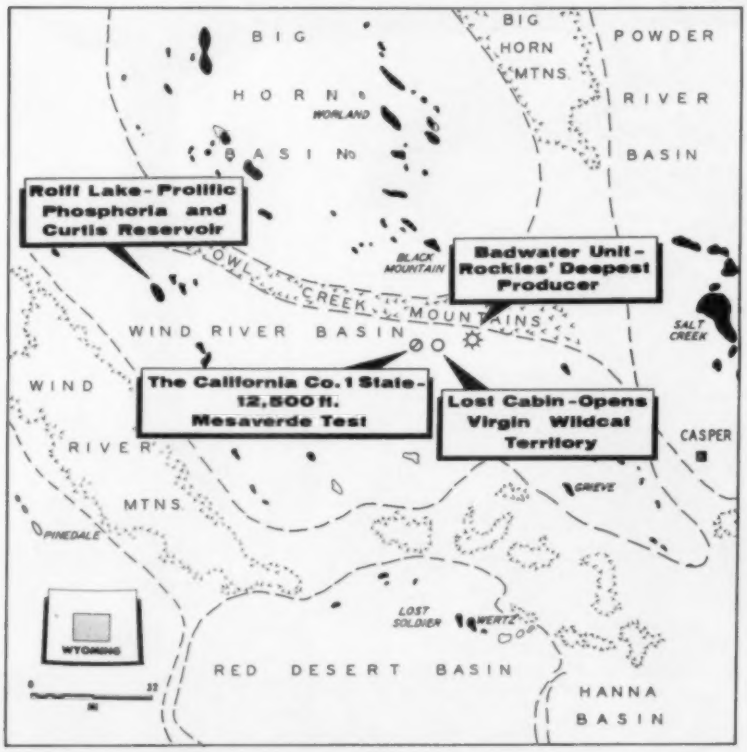


THE WIND RIVER BASIN, jammed in between mountains on all sides in West-Central Wyoming, expects a lively oil and gas search in the coming months. Recent discoveries at Rolff Lake, Lost Cabin, and Badwater Unit give new prestige to this small but important oil province.

"Forgotten provinces" are being remembered

BY JOHN C. McCASLIN

A QUIET but highly significant exploratory campaign is under way in one of Wyoming's nearly forgotten oil provinces, the Wind River basin. Three recent discoveries in this relatively small and complex basin are expected to set off a lively search for oil and gas. Particular emphasis will be put on the tremendous section along the highly disturbed northern border. Reasons for this new interest in the crammed-in Wind River basin are (1) the discovery of major oil production at Rolff Lake in the northwest near Dubois, (2) a rank gas discovery at Lost Cabin in virgin wildcat country, and (3) a new Rocky Mountain producing-depth record at Badwater Unit.

Major oil strike . . . Phillips Petroleum Co. opened Rolff Lake last year at its 1 Tribal wildcat in C SW NE 27-6n-3w in Fremont County. The well flowed 256 bbl. of oil in 4 hours through 2-in. tubing from the Phosphoria-Permian, and 79 bbl. of oil in 4 hours from the Curtis-Upper Triassic.

The Rolff Lake discovery is one of the best strikes in recent years in the northwestern portion of the Wind River basin. The confirmation well, 1-A Tribal, located 1½ miles southeast of the discovery well, added even more importance to the new reservoir. It flowed 396 bbl. of oil per day from the Phosphoria and 346 bbl. per day from the Curtis.

In January, Phillips made location for the third well in between the two big successes at 1 Rolff Lake-B. This one will also look for Curtis and Phosphoria oil. Rocky Mountain oil followers are looking for a field of considerable importance at Rolff Lake. The third well will be watched closely.

Virgin gas country . . . Important gas discoveries along the highly faulted, remote wildcatting country on the north fringe of the Wind River basin are opening up one of Wyoming's least-tested wildcat frontiers. The California Co. and Pure Oil Co. are tapping commercial gas production in a complex area of the basin where more than 20,000 ft. of sediments are believed present.

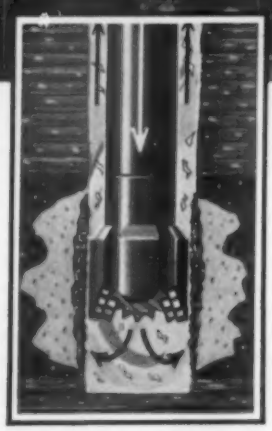
. . . Lost Cabin. The California Co. is drilling below 5,000 ft. at a wildcat 5 miles west of its recent Lost Cabin gas strike in Fremont County. The 1 State, NW NE SE 4-38n-91w, will hunt out the Mesaverde-Cretaceous at 12,500 ft. The Lost Cabin discovery well flowed 8,275 M.c.f. of gas per day from two Upper Cretaceous zones at 8,793-8,809 and 8,934-48 ft. Closest previous production to this discovery, the 1 Spratt, was across the Owl Creek Mountains at Black Mountain in the Big Horn basin. Nearest big **Wind River basin** production is far to the east at Poison Spider.

. . . Badwater. Just a dozen miles northeast of Lost Cabin Pure set a Rocky Mountain producing-depth record at its 1 Badwater Unit. It found gas in the Cretaceous at 16,472 ft. This well is on the very edge of the basin.

Spotlight on the north . . . Earlier predictions of a big year for the Green River basin in southwestern Wyoming are holding true, but that busy region may have a close runner-up in 1958, in the Wind River.

The last discovery of significance in Wind River was at Grieve in the far southeastern corner. Now the spotlight is on the northern edge of a basin that is bordered by sharp anticlines associated with major uplifts, by volcanic mountains, and by great overthrusts. The great thickness of strata in the northern part of the basin, ranging in age from Middle Cambrian to Eocene has not even been touched except at widely scattered places.

The trek has begun . . . Rolff Lake, Lost Cabin, and Badwater Unit are only a beginning. Keep an eye on developments along the Wind River basin's northern front.



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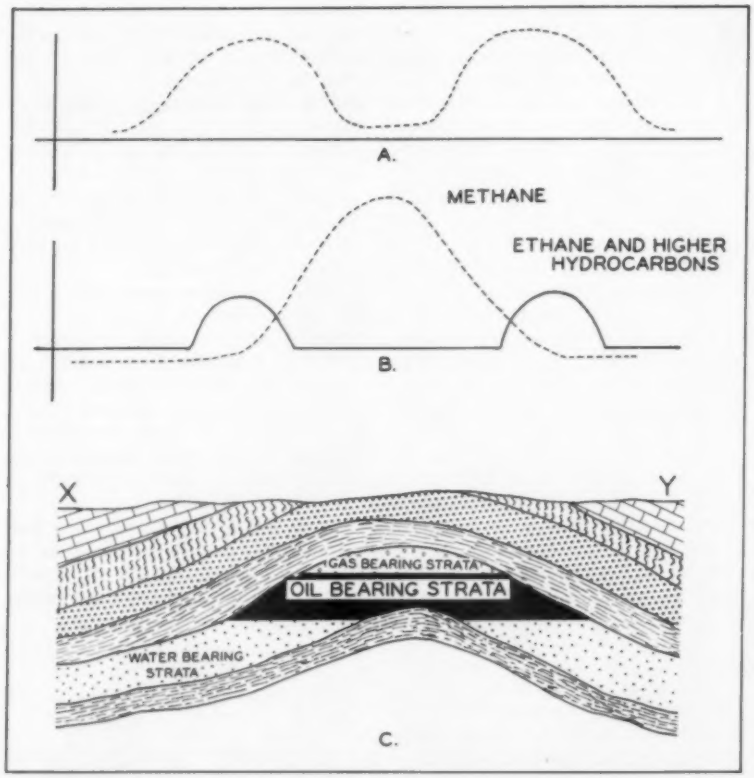

DISTRIBUTION patterns in the region of an oil pool are represented in the diagram above. Line A shows the hypothetical plot of variation in radioactivity along traverse XY. In B is shown the hydrocarbon concentration pattern along the same traverse, and C shows an idealized cross-section of the oil pool.

What causes

Variations in radioactivity intensity over oil pools?

Is there a mechanism by which certain natural radiation phenomena over oil fields may occur? Here is one man's opinion.

BY JOHN A. MILLER

A POSSIBLE explanation has been proposed by Hans Lundberg,[1] who suggested a mechanism of aqueous solution of the metal salts, and deposition at the surface as their sulfides.

Recent work carried out to investigate the chemical properties of uranium, plutonium and fission products of radioactive decay has made clear the ease with which many such metals form complexes with organic materials. This general fact is by no means a recent discovery, for such metals as platinum, vanadium and nickel have long been known to form such complexes, and oil with moderate vanadium content is not unknown.

Author is associated with the Department of Physics, The University, Edgebaston, Birmingham, England.

Attention should first be turned to the results obtained by Russian workers and also by Laubmeyer[2] who reported a marked trend in the distribution of hydrocarbons in oil fields, obtained by careful soil analysis. It was found that the greater concentrations occur in the soil situated over productive zones, while relatively lower values were reported from barren areas..

The diagram, attributed to the Russians, is an idealized representation of the significant hydrocarbon distribution patterns encountered in the region of an oil pool. High concentrations of methane are found in the soil air over the gas accumulations, while correspondingly high concentrations of the heavier fractions of hydrocarbons are noted over the actual oil.

Work in the field has shown that a curve, similar in character to that given for the distribution of higher hydrocarbons than methane, is obtained when the ground radioactivity is measured along a similar traverse. A definite correlation between high radioactivity and high hydrocarbon concentration, other than that of methane, makes itself apparent; it is intended here to examine the possibilities of this being justifiable.

Seepage is obvious . . . Quite clearly, some seepage of hydrocarbons is taking place, both in the liquid and gaseous phases. The fact that organic compounds may be detected chemically at the surface supports this hypothesis. Among these substances there will be a wide variety of chemical classes, both of the aliphatic or chain type, and aromatic, those having a cyclic nature. The latter are particularly diverse in chemical behavior and it is likely that a full chemical analysis of the soil would show only not the presence of hydrocarbons, but other chemical types besides.

If, for simplicity, the hydrocarbons only are considered, these may be classed into two main groups, the saturated and undersaturated. Saturated in this sense means that a full complement of electrons has been acquired by each element forming the group, and will consequently give the substance great chemical stability. Undersaturated implies that this condition is not fulfilled, and such compounds have a certain number of orbitals capable of forming chemical bonds with other elements or groups.

Chemistry of change . . . Elements capable of forming complexes with such compounds must have vacant orbitals which can accept electrons from

these compounds. In such reactions the hydrocarbon is termed the ligand, and may in this case be an olefine. Although an element tends to acquire as many coordinated molecules or groups as possible, the number of ligands it can in fact take is limited by two factors.

The first of these is the steric interference of the ligand groups. This effect increases with decreasing radius of the metal ion.[3] (e.g. zirconium accepts eight ligands, but totanium only six) and increased ligand "interference volume" (ethylene-diamine gives very stable complexes, but those formed by NN dimethylethylenediamine.

Me N H. CH_2. CH_2 NHMe

are much less stable[4] because of the methyl group attached to each coordinating nitrogen atom).

The second in the directional properties of available orbitals. Copper (Cu^{2+}) for instance uses dsp^2 hybrid orbitals to give four planar bonds. For a more complete explanation of the matter, ligand-field theory should be consulted.[5]

Ethylene, propylene and many other of the olefines from well-defined complexes with metals, but the bonding involved has long been under discussion. The earlier work in this field must be neglected in view of recent spectroscopic measurements[6] which have shown that the double bond (the characteristic of olefines) is still largely unchanged in the complex. Ethylene evidently acts as a donor molecule when complexing with platinum and "feeds" two of its electrons into the vacant dsp^2 orbitals of the platinous ion to form a coordinate bond. although the exact origin of the donated electrons is not clear.

It has long been known that uranium readily forms a complex with certain organic compounds related to butylene. These are usually produced in an inert hydrocarbon solvent and are quite stable. Should the transfer of radioactive elements take place by aqueous transfer, their partition coefficients between water and organic solvent must be in favor of the water. In the case of uranium, the solubility in water is dependent upon the valency state, for the "reduced form" of uraninum U^{4+} is relatively insoluble in water[7] whereas the converse applies to the higher valency state U^{6+}.

In all probability much of the uranium picked up under the reducing conditions prevalent in oil pools will be in the lower valency or "reduced state," for the change U^{4+} to U^{6+} is one requiring low energy, in fact less than needed to bring about the change Fe^{2+} to Fe^{3+}. Consequently, most of the uranium will tend to go into the organic solvent as a complex with more of the unsaturated hydrocarbon fraction.

Upward movement of complexes . . . The complexes thus formed will tend to migrate upward in the same manner as the other traces of hydrocarbon found at the surface, and then be decomposed on contact with the oxidizing conditions produced by the atmosphere.

Such a mechanism would account for the associated highs of radioactivity and hydrocarbon concentration, but the radioactive low encountered at or near the center of the oil pool must also be explained.

This is because methane, which by soil analysis is found to be so plentiful there, is totally incapable of complexing actions. It is a fully saturated, very stable molecule, having the four hydrogens directed toward the corners of a regular tetrahedron, with the carbon atom situated at the center, and the whole linked by an sp^3 hybrid orbital.

Upon this hypothesis radiation phenomena observed in oil fields is attributed to a mechanism of organic complexing, taking place under reducing conditions.

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Oil man declares:

Geologists must be "earth scientists"

B. W. BEEBE, vice president and director of Keating Drilling Co. and a prominent oil geologist in his own right, aired some of his views on petroleum geology in a recent talk to the Tulsa Geological Society. Title of his talk was "A Philosophy of Oil Exploration."

Beebe declared "We, as petroleum geologists, have failed to maintain the high educational and professional standards required of us as professional scientists." He pointed out that at first glance, the profession has established an enviable record. "But," he added, "our profession has grown rapidly, and we have produced too many technicians and geological clerks instead of developing real professional talent. A petroleum geologist must first be a geologist, an earth scientist." Beebe believes that too few geologists realize this fundamental concept.

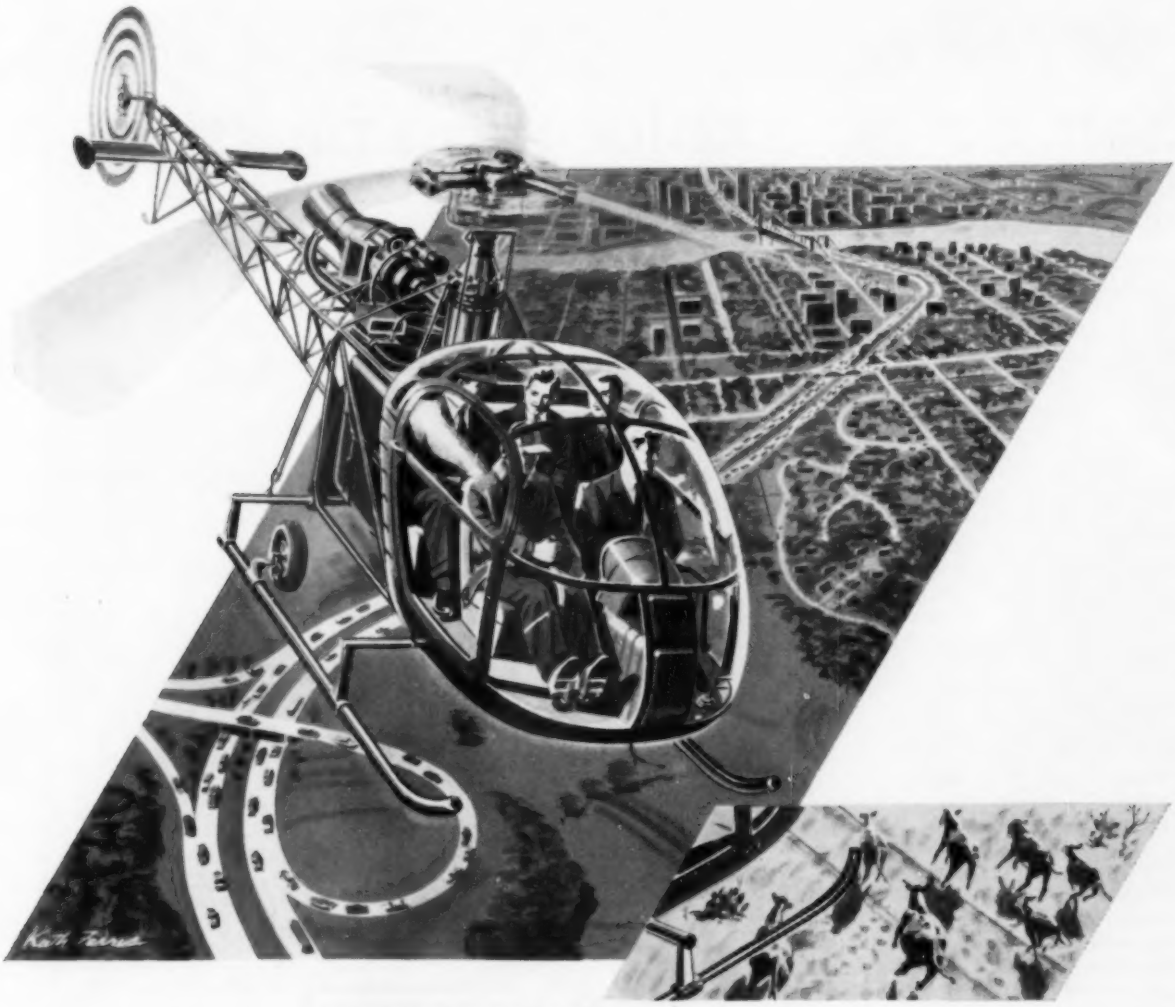
B. W. BEEBE

"Geologists face an unprecedented challenge to produce enough oil for our expanding economy," Beebe forecast. "Unless we change our approach to many of our problems, we will fail to meet our requirements. Geologists must develop a positive approach to oil finding rather than wasting valuable time condemning nonproductive regions that have all the necessary requisites for oil provinces," he insisted.

How can we improve our oil-finding ability? Beebe has an answer. He suggests more rigorous training in fundamental geology and the application of these principles.

A well-trained geologist must be able to gather information, analyze it, and reach sound conclusions. "More important," Beebe continued, "he must be able to communicate these conclusions clearly and concisely so that immediate action will follow."

"Geologists must realize that any area of marine rocks in any appreciable thickness is a potential producing province, but that production will only be found by a positive philosophy and salesmanship," he concluded.



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In East Texas

Salt-dome exploration picks up

Salt-dome geology, say the geologists, is a complex subject not too well known. So much oil has been found in the cap rock on top of them and in pinchout sands flanking them, however, that oil men welcome any news of their development.

BY CARL HOOT

SALT-DOME exploration news last week came from East Texas—where 18 domes are known to exist. Domes on which production has been found are: Boggy Creek, Hainesville, Bethel and Concord. Small production at Concord has been abandoned.

Successful development in the immediate area of these salt domes in East Texas has been skimpy, but conditions are generally the same and operators are always hopeful of another find like Spindletop—or Pierce Junction, for a later example.

The current news includes a second gas well at Bethel field in the Rodessa - Lower Cretaceous, located on the northeast flank of Bethel dome in Anderson County. This dome attracted attention a couple of years ago when the discovery well went into Woodbine (Upper Cretaceous) pay sand after drilling through a salt overhang. Other salt-dome exploration ventures include Texaco's 1 Arthur Rabe, a wildcat 2 miles northwest of the town of Keechi, on Oakwood dome. On Butler dome, Perryman & Greer's 6,000-ft. test was near contract depth waiting on interpretation of electric logs. The two latter tests are in Freestone County.

EAST TEXAS salt-dome developments include a second gas well at Bethel dome and wildcat drilling on Oakwood and Butler domes. Of the 18 salt domes discovered so far, 17 are in the section of Texas shown above. The other is Marquez, in Leon County.

Bethel gas prospect . . . The second gas well on Bethel dome is The Texas Co. 1 G. B. Givens. Location is east of Woodbine oil production and ½ mile south of the discovery of Rodessa gas in the field.

At this report, operators had perforated the Rodessa between 8,340-70 ft. A heavy gas flow started immediately after perforations but was shut in. No estimates were made on the rate of flow, but shut-in. tubing pressure was 3,400 psi.

No. 1 Givens was drilled to 8,970 ft., in the Travis Peak. First indication of Rodessa gas pay was a 12-ft. core recovered from 8,320-70 ft. A core from 8,370-92 ft. recovered an additional 22 ft. of gas and porosity and cores from 8,392-8,422 ft. had good gas shows.

Oakwood dome. . . Texaco had let contract and was moving in rotary tools at its 1 Arthur Rabe, on the southwest flank of Oakwood dome, 2 miles northwest of Keechi townsite in southeastern Freestone County. Drilling will go to 7,600 ft. which should test the Woodbine sand.

Location is on a large block of acreage held by The Texas Co. and is approximately ¼ mile southeast of a Woodbine failure drilled last year. This test was 1 Settlemyre. Total depth was 6,568 ft. Oil shows and salt water were reported in the Woodbine at 5,962-72 ft., after drilling through the salt overhang at 5,653 ft.

Butler dome . . . W. C. Perryman and George Greer 1 Daniel Memorial Orphanage had reached 5,408 ft. at last report and was running electrical

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surveys. The drill went into salt at 3,432 ft. Shows of oil were reported in Blossom sand around 3,250 ft. Location is 2 miles east of the town of Butler, on Butler dome.

Background on domes . . . Spindletop field, near Beaumont, may not have been the original salt-dome discovery, but it set off the big search for similar structures. Its physical surface appearance was a hill, or mound, but discovery production in 1901 was from the broad flat top of the salt spear itself. By 1926 geology and geophysics had entered the picture and flank production of major proportion was found in the uplifted zones of Spindletop.

In 1927 a wildcat in northeastern Anderson County, East Texas, found oil at Boggy Creek dome. The opener cut loose with a "10,000-bbl. per day flow," according to early reports from Woodbine sand at 3,834 ft. Production records, however, show the well flowed something like 60 bbl. an hour.

Boggy Creek has been called a turning point in the history of East Texas oil development, not so much for the oil produced but because it started a seismic search throughout the East Texas basin. The discovery's life as a big well was short, as production fell to around 75 bbl. per day, but it opened a whole new province for exploration.

Most of the early searching for salt domes was directed toward surface mounds, usually associated with the piercement-type dome. But in East Texas, operators found salt domes at Bethel, Troup and Hainesville had little evidence of structure at the surface. Depth to the salt on most of them is 600 ft. or less, but it ranges from 120 ft. at Palestine to 6,000 ft. at Concord.

Since salt domes produce stratigraphic traps and other ideal conditions for the accumulation of oil, the lack of success in finding that oil in East Texas has brought up some new thinking. It includes ideas along the following line: That salt overhang may be deeper than is usually associated with salt domes: Oil may have migrated away before intrusion of the salt spear: Flank structures are probably much more complicated than supposed, and pools may lie farthea from the salt core.

An interesting sidelight on the latter thought is that the main portion of Neches field in Anderson and Cherokee counties lies parallel with Boggy Creek production but is separated by a long nonproductive strip a couple of miles wide. Neches is regarded as East Texas' most important recent discovery, with ultimate recovery estimates of over 100,000,000 bbl. In area it covers over 9,000 acres.

Salt domes are known to stretch in a 50,000-sq.-mile arc across the lower portion of the United States, from New Orleans to Brownsville, Tex. In this area, 126 have been found in Louisiana, 83 in Texas, 52 in Mississippi, and 3 in Alabama. They have been found in all types of terrain, from flat prairies to swamps, and lately geologists have been taking a second look at the hills and peaks, known as "sea mounds" off the Gulf of Mexico.

AMA calls for research

THE American Management Association held a seminar on "Managing Exploration and Production" in New York City, January 27-29.

Zeb Mayhew, assistant producing coordinator for Standard Oil Co. (N. J.), was chairman of the group, and Norman Donald, manager of exploration, St. Joseph Lead Co., was associate chairman.

Most of the discussion centered around "Planning for the Future" and "Special Problems of the Mining and Petroleum Industry." Heavy emphasis was placed on the need for a major breakthrough in methods and a coordinated industrial research program.

It was brought out that the oil industry is not doing enough research and that the load is being carried by major companies and equipment manufacturers. Special attention was given to the need for a breakthrough in geophysical and drilling methods. The principal subjects in need of basic research were cited as ore genesis and the origin of oil.

Another seminar on managing exploration and production will be sponsored by the AMA on April 28-30 in New York. John Payne, vice president of mining and exploration for American Metal Climax Corp., will serve as chairman, and H. H. Hinson, vice president and general manager of foreign operations for Continental Oil Co., will serve as associate chairman.

Exploration people who desire to atend these seminars should write directly to the Seminar Registrar of the AMA, 1515 Broadway, Times Square, New York 36.

Frio Tapped in South Texas Strike

An important South Texas discovery is Northern Pump Co. 1 Elmer Sexauer, Ricardo field wildcat in Kleberg County. The well recovered oil on drill-stem test of the Frio plus several gas sand sections, assuring a multipay discovery. The well is located in Lot 11, Block 41, Kleberg Town & Improvement Co. Subdivision. Gas and gas-distillate sands were tested at 5,529-34, 7,059-65 ft., 7,064-74, and 7,074-84, and 8,112-22½ ft.

The only pay in the area now is about 3,000 ft. north where gas-distillate is found at 8,200 ft. and Catahoula oil at 3,000 ft.

Sparta Sand Well Hits On Texas Gulf Coast

A new Sparta sand gas well in one-well East Millican Dome field, 2 miles northeast of Millican townsite in Brazos County, Texas Gulf Coast, officially flowed 30 M.M.c.f. per day on an estimated absolute open flow. The well is Lone Star Producing Co. 2 W. B. Keyser. Perforations in the Sparta are at 2,622-27 ft.

This new well is on the A. Millican Survey, 2,950 ft. southwest of the 1 Lena Williams. The discovery well, a Sparta producer, was completed 13 months ago for 47 M.M.c.f. of gas per day from perforations at 2,593-99 ft. This new gas-producing area is about 3½ miles northeast of Wilcox production in Millican field.

New Four Corners map shows exploration action

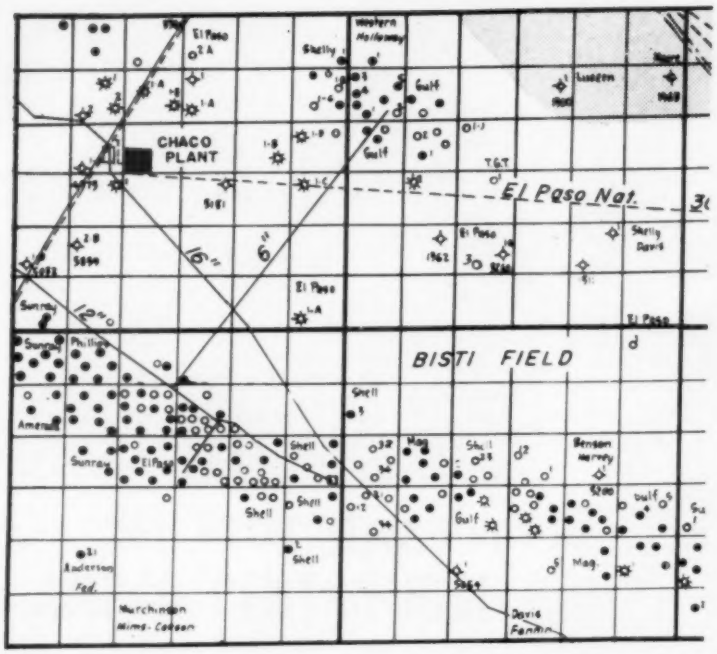
THE BISTI and Gallegos trends in northwestern New Mexico's San Juan basin are reaching a new high in exploratory and development drilling. More than a dozen new locations were announced on these two trends late in February.

Bisti, the largest oil producer in the San Juan basin, is a Gallup-Cretaceous field. Reserves are estimated at 3,000-4,000 bbl. per acre in this fast-growing northwest-southwest trending field. A new map of the Four Corners region by L. J. Wilson, Box 6277, Houston 6, includes this now-famous field plus the Aneth area of southeastern Utah, portions of northeastern New Mexico, and southwestern Colorado.

Scale on the large colored map is: 1 in. equals 16,000 ft. Each individual well is spotted on the map which includes pipelines, highways, towns, and processing plants.

The new Gallegos-Gallup trend, not labeled on the map, is just north of Bisti and south of the Blanco gas field. The new trend is separated into two sections, one northwest of the Chaco plant, the other to the northeast.

Wilson's large-scale map of the Four Corners region includes an index map of the areas inside Blanco gas field itself. Scale in this index map is: 1 in. equals 8 miles.



BISTI field and Gallegos trend are shown on this new map of the oil and gas fields of the Four Corners region. This section of a four-state map shows pipelines, individual wells, highways, and processing plants.

Washington's Olympia test is abandoned

SUNSHINE MINING CO. has abandoned its latest test in Washington. They pulled off of 1 Minard at 5,032 ft. after running an electric log in the wildcat located in the Duck Lake region of the Olympia Peninsula.

This site was about 5 miles south of their Ocean City discovery well.

Louisiana offshore gas field opened

NEW GAS production was opened in the Gulf of Mexico off Vermilion Parish, coastal Louisiana. The new offshore strike is Zapata Offshore Co. and Felmont Oil Co. Block 86, 1 OCS-0172 (State Lease 1446).

The offshore find flowed 3,600 M.c.f. of gas per day and 113 bbl. of distillate from perforations at 10,828-34 ft. on 12/64-in. choke. State potential is due.

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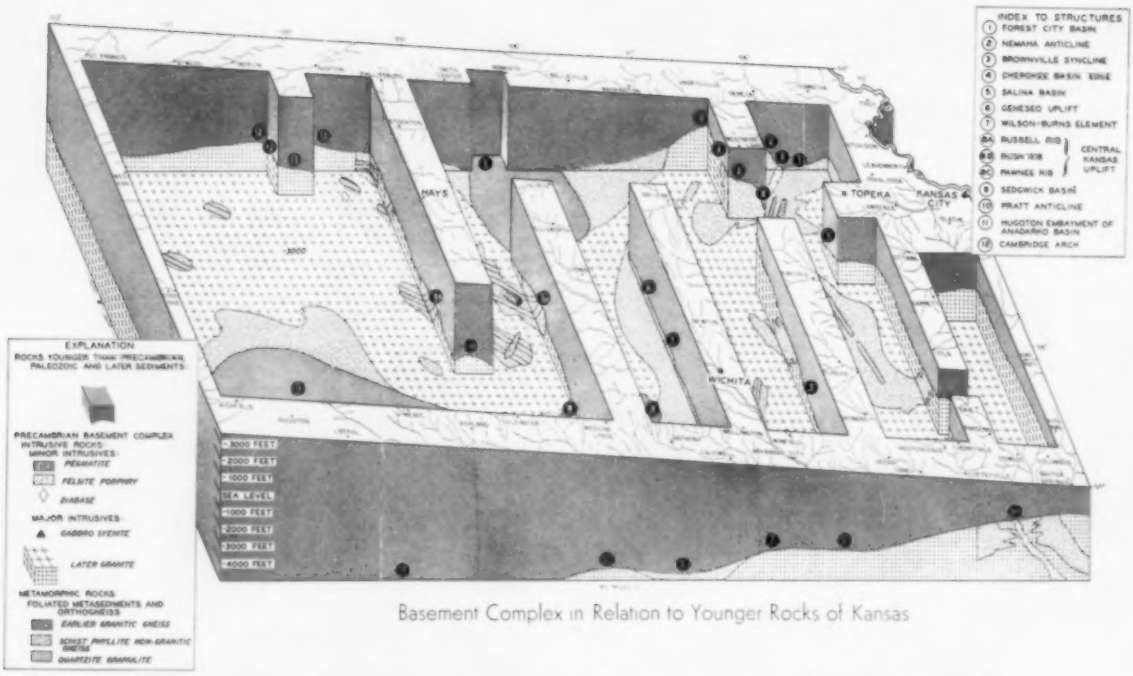
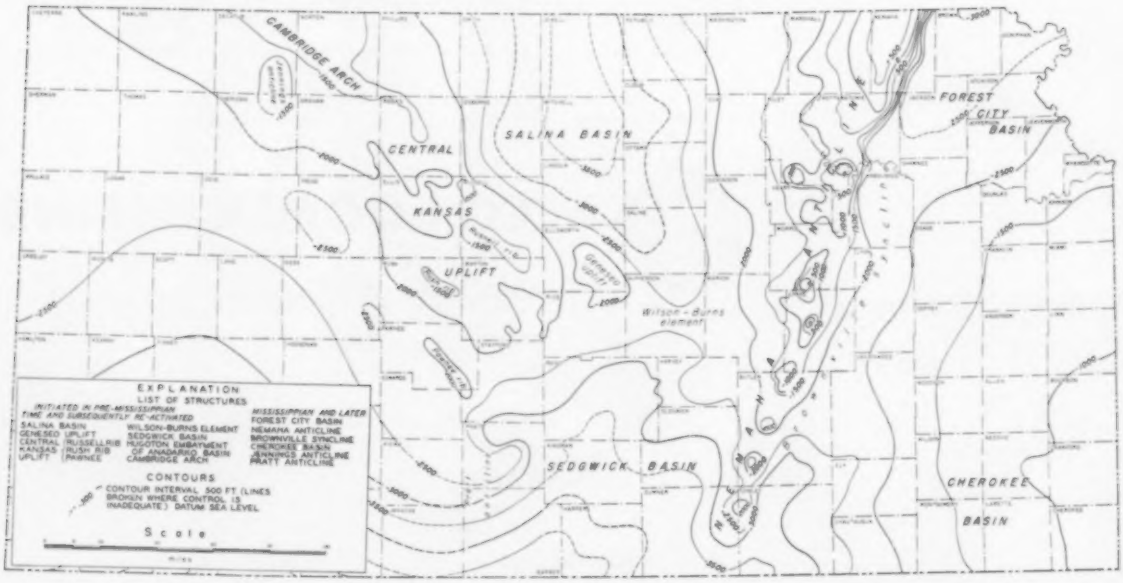


Basement Complex in Relation to Younger Rocks of Kansas



In a new bulletin . . .

Kansas looks at its Precambrian

A new bulletin, "The Precambrian Rocks of Kansas" has been issued by the University of Kansas Publications, Lawrence, Kans. It is Bulletin 127, part three, State Geological Survey of Kansas, authored by O. C. Farquhar.

Precambrian rocks are not exposed in Kansas, but information concerning them has been assembled from subsurface records. More than 1,600 test wells for oil have been drilled through the cover of younger formations to the Precambrian "basement complex," in which the oldest rocks belong to a metamorphic group.

Precambrian rocks have been affected by major movements in at least four Paleozoic and later periods. Principally in central and eastern Kansas, anticlinal structures have resulted from recurrent uplift. The uplifted areas and the intervening basins are buried at considerable depths beneath Paleozoic rocks.

Both the Precambrian surface and all overlying rocks in existence at the time when movement took place show the effect of that movement. Structures in post-Precambrian strata are controlled by irregularities of the uplifted Precambrian surface only locally, however, where this surface was temporarily exposed and eroded.

The general arrangement of the Precambrian rocks is shown on a contoured map and in a block diagram (above).

World events stir AAPG–SEPM meet

SCIENTIFIC though they may be, the titles of some 33 major speeches to be delivered at the national convention of geologists and paleontologists in Los Angeles show the impact of current world events on the course of oil. The meeting opens today, March 10.

The technical titles of the scientific writings being presented indicate clearly that the research and science of the American oil industry are deeply concerned with the problem of keeping America's fuel lifeline in being.

For example, the American Association of Petroleum Geologists and the Society of Economic Paleontologists and Mineralogists will hear talks about the geology of the Soviet Union, data about underground nuclear detonation, prospects for oil discovery in free nations bordering the Pacific Ocean, the oil future of Indonesia, the Arctic and its oil basins, in addition to the latest scientific developments which apply to the ever more difficult search for domestic oil.

Small-pool activity hiked in Ohio area

The most active of the small pools in the Pennsylvania grade area is southeast of New Lexington in Pike Township, Perry County.

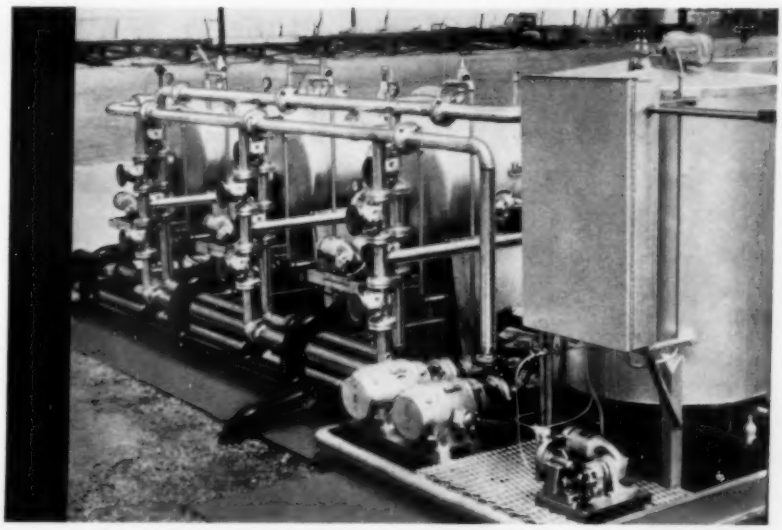
Six strings are drilling for Clinton sand production averaging 120 bbl. initial daily. A 1,000-ft. southwest extension by Natol Corp. on Harry Starner, Section 27, found the sand at 3,346-66 ft. and made 100 bbl. and an estimated 2 M.M.c.f. of gas in 24 hours after fracture.

Snow in Michigan forces shutdown

THE WORST snow conditions in 20 years prevailed in Michigan, forcing numerous drilling well shutdowns and delays in completions. Only preliminary tests were possible due to weather conditions on Muskegon Development Co. 1 Mion NW NE SW 29-12n-14w, Sheridan Township, Newaygo County, newest Michigan field prospect.

Wildcat logged Traverse lime at 2,118 ft. (elevation 733 ft.) and drilled pay at 2,188-21 ft. Well carried 1,750 ft. of oil and 125 ft. water natural.

New field opener prospect is located 10 miles southwest of Kimbal Lake field.



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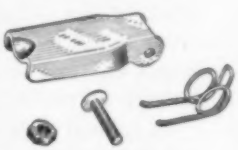

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DISCOVERY of oil at Beatton River gives British Columbia its first strike of the year, bringing to seven the number of producing oil fields in the province.

B. C. potential boosted with hit

BRITISH COLUMBIA has seven oil fields as a result of Triad Oil Co., Ltd., striking oil at its 1 Beatton River wildcat, 4 miles northwest of the Milligan oil pool in the northeastern portion of Canada's westernmost province.

A drill-stem test in the Triassic "D" zone at 3,730-70 ft. recovered 3,500 ft. of clean light gravity oil.

Several fields . . . Oil has been found in several areas of northeastern British Columbia in the past 2 years, making it an oil province of the future. Previously only gas was produced in B.C.

Oil has been found at Blueberry, Buick Creek, Milligan Creek, Boundary Lake area, Alces, Charlie Lake, and in Fort St. John gas field proper. A summary of production in British Columbia's oil fields last year, as prepared by the Daily Oil Bulletin of Calgary, shows these data by fields:

. . . Boundary Lake, a Triassic field with four wells, produced 158,976 bbl. of oil in 1957 (cumulative production is 266,097 bbl.).

. . . Southwest Boundary Lake, a Triassic field with five wells, produced 41,144 bbl. in 1957 (cumulative total is 41,144 bbl.).

. . . Fort St. John (Triassic "C" field) with four wells, produced 126,776 bbl. in 1957 (cumulative total is 158,695 bbl.).

. . . Fort St. John (Permo-Penn field) with one well, produced 7,866 bbl. in 1957 (cumulative production is 16,962 bbl.).

. . . Charlie Lake, a basal Gething sand (Triassic) field with one well produced 3,997 bbl. in 1957 (cumulative production the same).

Maritimes awaken to new exploration surge in East Canada

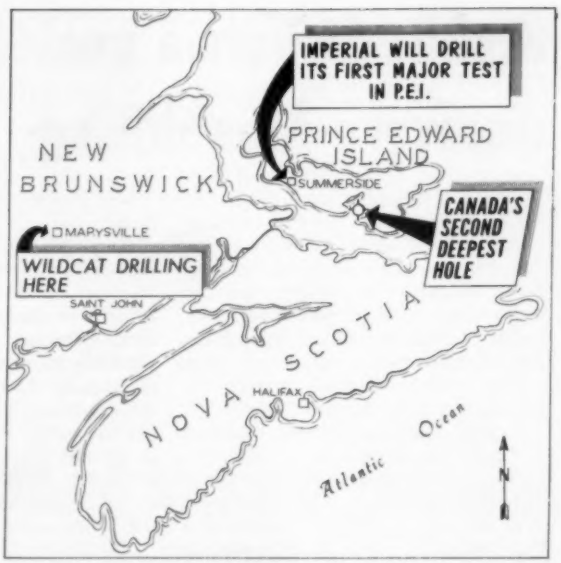
RENEWED exploratory interest in the Maritimes of eastern Canada is sweeping Prince Edward Island and New Brunswick. Imperial Oil Co. will drill near Wellington, P.E.I., about 14 miles from the town of Summerside. This will be the firm's major venture in P.E.I.

The decision to drill near Wellington followed extensive exploratory work in the area. The company sent a special train carrying 100 of its drillers and their families to the Maritimes.

Prince Edward Island is the site of Canada's second-deepest hole, the famous old Hillsborough wildcat, bottomed near 15,000 ft.

In New Brunswick . . . Harold M. Young, leader of a local New Brunswick syndicate, reports a wildcat drilling below 400 ft. near the town of Marysville. Location of the wildcat is in an area of surface seepages. There is some small production in this Maritime province.

The search for oil in the Maritimes began in the late 1800's. Geologically, the Maritimes are part of the great Appalachian basin. Sediments are thick, prospects good for finding oil.



EASTERN Canada's Maritimes are due renewed exploration near Summerside on Prince Edward Island and in New Brunswick.

Alberta wildcat gets Pennsylvanian gas

Northwestern Alberta's Big Mountain Creek area wildcat, Triad-Pan American 3-26, 24 miles southwest of Grand Prairie, flowed 13 M.M.c.f. of gas per day from the Permo-Pennsylvanian.

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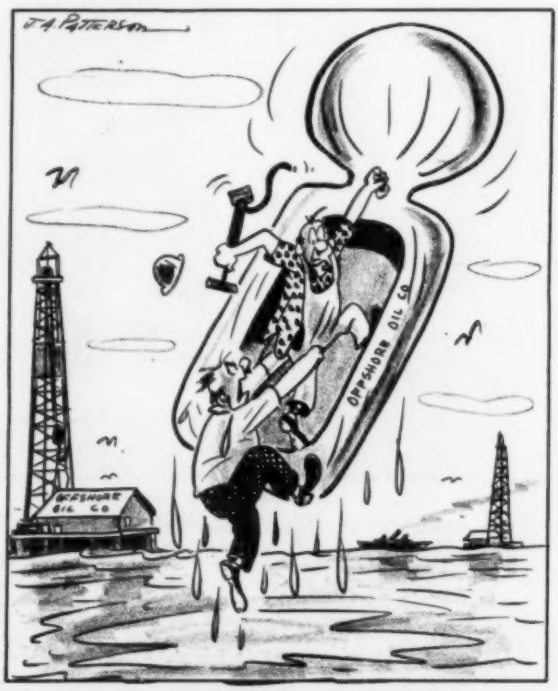


"I knew you were pumping too much air into the fool thing."

Prolific California pool discovery fires drilling

A PROLIFIC new pool discovery by W. J. Hamilton in the north area of the Huntington Beach field, Orange County, has spurred a mild drilling boom which shows nine rigs working in the play at the present time.

The Hamilton discovery well, 1 Hamilton fee, was a redrill job on a well formerly completed in shallower oil sand at 2,601-80 and 2,730-65 ft. in 1953. Hamilton moved back on the hole and redrilled it to 4,180 ft., tapping the Hunter zone in an interval at 4,410-4,668 ft. The well flowed 800 bbl. daily initially but production fell off rapidly to around 300 bbl. daily in a couple days. After 3 weeks, it quit flowing and has been put on the pump making 150 bbl. daily of 22-gravity crude, 46 per cent cut.

This new zone correlates with the "C" zone of the Miocene and lies below the regular productive interval of this part of the field. Closure is by fault.

Since the discovery, the pool has been extended in several directions. The most notable extension was D. W. Elliott's 4 Riggle 700 ft. northwest of 1 Hamilton. This well was completed in the new zone at 4,270-4,686 ft. making 650 bbl. daily of 22°-gravity crude, 38 per cent cut. Like the discovery well, 4 Riggle was a deepening job of an older well. In 4 Riggle's case, it was a much older well. It was originally completed in the shallower zone in 1921 making 5,500 bbl. daily.

Another significant extension to the Hamilton find was Yunker, Morton and Dolly 1 H. B. Fee, 600 ft. southeast of the discovery. This well, also a redrill job, was completed at 4,412-4,715 ft. making 322 bbl. daily of 23°-gravity crude, 34 per cent cut.

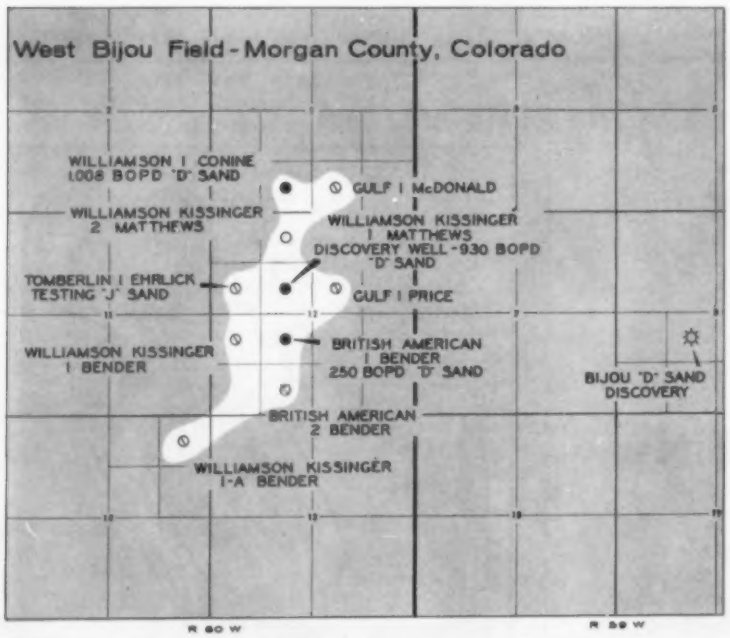
There have been several other successful completions in the Hunter zone, including one by Richfield Oil Corp. The Texas Co. was also moving in a rig to deepen a well in the same play to the new zone.

The latest completion in the Hunter zone is W. E. Nicolai and W. J. Hamilton 3 Nicolai and Hamilton, located about 250 ft. northeast of Hamilton's discovery well. This newest well to tap the Hunter was completed flowing 300 bbl. daily of 23°-gravity crude, 1 per cent cut, through 18/64-in. choke. It is selectively perforated between 4,330-4,585 ft. This well was originally completed in the shallow zone in 1952.

Texaco Completes Northwesterly Offset To Tejon Valv Find

The Texas Co. has completed a northwesterly offset to its Tejon Ranch new Valv pool discovery scored last October in southern Kern County. The offset, 3 Tejon Ranch, was put on the pump making 167 bbl. of crude, 19° gravity, 9 per cent cut, from perforations at 5,390-5,436 ft.

California highlights . . . Shell Oil Co. has staked location for a 10,000-ft. Pliocene test southwest of its Saticoy field production. This will be another effort to find production beneath the Oakridge fault . . . Marport Oil Co. has staked locations for two wildcats 6 and 7 miles northwest of San Ardo field production, Monterey County . . . Union Oil Co. has plugged back its 15,117-ft. 1 U-R-S-Fillmore Unit in the Fillmore field to 10,000 ft. and was preparing to redrill . . . Shell Oil Co. abandoned 31x-3 KCL, a 11,882-ft. wildcat a mile southwest of Pleito Creek oil field in southern Kern County.



Fast-developing Bijou field simmers . . .

COLORADO is the scene of a quickly-changing oil picture which features the Denver basin's most promising discovery in many months —West Bijou. The Morgan County discovery has three wells producing in the Dakota "D" sand, several others drilling, and new locations being spotted weekly. Production is also indicated in the "J" sand on the southwest side of the field. The big potentials of the completed wells are among the highest in recent years in the Denver basin. The field did receive a jolt last week, however, at two Gulf Oil Corp. wells. Gulf quit at the 1 Price and the 1 McDonald after finding noncommercial shows. British-American Oil Producing Co. swabbed 150 bbl. of oil in 3 hours at the 2 Bender, a south extension to West Bijou field. Production is from the D sand at 6,196-6,208 ft.

Seventh field for NW Oklahoma's Woodward

WOODWARD COUNTY added its seventh producing area last week. The new discovery well for northwestern Oklahoma's big Morrow push is Calvert Drilling Co. 1 Young, NE NE 17-24n-18w.

During tests the well flowed up to 2 M.M.c.f. per day, natural. Operator now plans to acidize before further tests.

This new wildcat discovery is 15 miles northeast of the city of Woodward field, another Morrow gas area. The county has five named produced areas: Northeast Woodward, West

Curtis, Cedardale, Southeast Woodward, Woodward Townsite, and an unnamed oil pool northwest of Sharon in the southwestern part of the county.

Catesby Field Moves North in Ellis County

Northeast Catesby field, a Morrow gas producer in Ellis County, northwestern Oklahoma moved north. Pan American Petroleum Corp. 1 Moyer, C NW SE 19-24n-25w, is an indicated north extension discovery to the new field. First production tests got up to 3,970 M.c.f. of gas per day on 6-hour test of Morrow-Pennsylvanian sand perforations at 7,995, 7,997, 8,013, and 8,017 ft.

The Catesby area is the most successful of three new fields in Ellis County—an area which was dormant until last year. There are five producers in the Morrow gas reservoir.

Ellis County's reentry into the production scene in northwestern Oklahoma is part of the so-called Woodward trend that has been developing in northwestern counties the past 2 years. The pre-Premian success is not limited to just northwestern Oklahoma—it spills over into Lipscomb County, Texas Panhandle, and into the Oklahoma Panhandle.

AAPG lecturer discusses geopolitics

DR. H. A. IRELAND, professor of geology at the University of Kansas, is on an extended lecture tour sponsored by the American Association of Petroleum Geologists. Title of Dr. Ireland's talk is, "Geopolitics and Oil Development in the Middle East."

According to Ireland, "Oil production in Iraq and Iran is, for the most part, found in reservoirs composed of fractured limestones or reefs ranging from Jurassic to Tertiary in age. Production occurs in long, gently folded anticlines sealed by evaporites. Production of oil in Saudi Arabia and Kuwait is found in anticlines which may have resulted from deep-seated movements along Precambrian faults.

"Sediments and source beds accumulated in a great geosynclinal basin lying between the Hedjaz massif westward along the Red Sea and a positive area northeastward in southern Russia or Central Iran. Tectonic pressure from the northeastward folded the eastern edge of the basin into the Zagros Mountains; the folds diminish in magnitude southwestward and afford traps for accumulation of oil.

"The United States has about 13 per cent of the world petroleum reserves, and yet produces 48 per cent of the oil consumed in the free world. This country consumes 56 per cent of world oil production. On the other hand, the Middle East contains more than 65 per cent of world petroleum reserves, but consumes only a small portion thereof.

"By 1966, it is estimated by the Chase Manhattan Bank that demand in this country will be double our 1956 production. This tremendous increase in consumption inevitably must lead to ever greater imports, because our discovery rate is not keeping pace with demand. Oil in the Middle East, therefore, assumes an increasing importance, not only to the free foreign world, but to this country. Most of the oil used in western Europe presently is produced in the Middle East.

"The Middle East is in a state of rising nationalism which must be recognized by the United States and the free foreign world. The people and governments of the Middle East long have looked to the western world, but colonialism, failure to live up to agreements, bumbling policies, and above all, a preferential attitude toward Israel, have alienated the Arab world.

"Some of the Arab nations have

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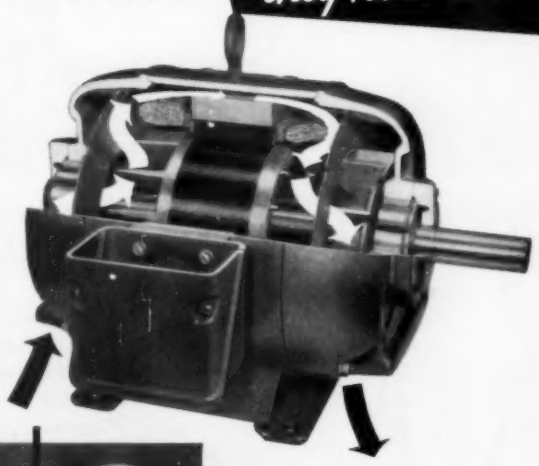

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sought and received help from Russia. The Arab nations are united uniformly in hostility toward Israel, not because its people are Jewish, but because the people are chiefly foreigners who have dispossessed the Arabs of homelands occupied for centuries.

"The economic future, insofar as oil is concerned, of this country and the free foreign world, is intimately associated with the core of Arab mistrust and dislike of the western support of Israel.

"Should we find ourselves in another World War, and even though we could maintain control of the oil in the Middle East, it is doubtful that the oil would be available through present pipelines controlled by Syria, and the Suez Canal controlled by Egypt, both of which lean towards our possible adversary.

"Our foreign policy has not always taken into consideration the strategic importance of these Arab nations. With the possibility of a pipeline located across the Negev from the Gulf of Aqaba, Israel becomes most important geographically.

"Geopolitics and oil development of the Middle East are inextricably entwined. If we are to maintain our position, our foreign policy must take this factor into consideration.

"Our foreign policy traditionally is one of high moral tone, protective to small nations such as Israel, but we must recognize that our economic and political future is in part contingent on the friendliness of the Arabs, and our policy toward Israel requires recognition of this fundamental concept," Ireland declares.

Three Illinois finds show Mississippi pay

THREE ILLINOIS counties figured in recent discoveries—White, Saline, and Wayne.

Kendall-Davis Drilling Co. has begun production tests at its new discovery in White County, ½-mile west of Crossville. The McClosky-Mississippian discovery pumped 21 bbl. of oil per hour on pump after treatment. Perforations are at 3,238-43 ft.

In Saline County, 4 miles northwest of Harrisburg, Slagter Producing Co. is testing the Aux Vases-Mississippian lime at 2,833-41 ft. at the 1 Cecil Simpson in NE SW NW 30-8s-6e. This one flowed 16 bbl. of oil hourly after treatment. Location is 1 mile from production.

A Wayne County wildcat, Walter S. Norton et al 1 Fitch, NE NE SW 11-1n-8e, pumped 200 bbl. of oil per day from the Rosiclare-Mississippian at 3,097-3,102 ft. Location is 3 miles northwest of Mount Erie.

Successful Wildcats

KANSAS

Ellis County: Franco-Central 12 Potter, SE SE NW 29-11s-16w. IPP 88 BOPD, 20 per cent basic sediment and water, 31°, Pleasanton sand 3,278-83 ft. TD 3,420 ft. New pay in Potter pool.

Don Pratt 1 A. C. North, SE SE NW 21-15s-20w. IPP 82 BOPD, 6 per cent water, 37.5°, congl. 3,864-70 ft. TD 4,002 ft. Opens Stock Range pool.

Alpine Oil & Royalty Co. 2 John Roth, IPP 176 BOPD, 37.8°, Arbuckle 3,523-30 ft. TD 3,530 ft. New pay in Southeast Degenhart. SE SW NW 23-15s-17w.

Trego County: Burch Drilling Co. 1 Benson, SW SW SW 21-12s-22w. IPP 73 BOPD, 15 per cent water, 38°. Lansing 3,724-27 ft. TD 4,096 ft. Opens Northwest Ogallah pool.

Wichita County: Republic and Musgrove Drilling Co. 1 Nelson, C NW NW 16-17s-27w. IP 8 BOPD, 1 per cent water, 26.3°, Marmaton 4,528-32 ft. TD 6,000 ft. Opens Carwood pool.

Rush County: Solar Oil Co. 1 Betz, NE NE NW 8-18s-16w. IP 3,317 M.c.f. of gas per day, congl. 3,529-44½ ft. TD 3,560 ft.

Rice County: Nadel & Gussman 1 Hass, SW SW NW 6-19s-10w. IP 340 BOPD, 39.8°, Arbuckle 3,342-47 ft. TD 3,347 ft. Opens South Mary Ida pool.

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Cherry Drilling Co. 1 Miller, SE SE NW 3-19s-6w. IP 116 BOPD, 35°-gravity, congl. 3,299-3,313 ft. TD 3,313 ft. Opens Rellim pool.

Ness County: Leben Oil Co. et al 1 Petersilie, NW NW SE 14-20s-24w. IP 17 BOPD, 38°, Miss. 4,389-93 ft. TD 4,405 ft. Opens Petersilie pool.

Barton County: Leben and R.S.C. Oil Co. 1 Stolz, SW NE NE 13-20s-14w. IP 141 BOPD, 6 per cent water, Lansing 3,403-09 ft. TD 3,625 ft. New pay in Harrison pool.

Marion County: Adair Oil Co. and Lee Phillips, SW SW SW 25-21s-4e. IP 91 BOPD, 37°, Viola 2,429-31 ft. TD 2,431 ft. Opens Fairplay pool.

Hamilton County: Kansas-Nebraska Natural Gas Co. 1 Wedel, C NE NW 1-22s-41w. IP 2,632 M.c.f. of gas per day, Permian 2,752-68 ft. TD 5,559 ft. New field.

Stafford County: Sunray-Mid-Continent Oil Co. 1 P. Omlor, NE SE SE 10-22s-14w. IP 85 BOPD, 35°, Lansing 3,550-59 ft. TD 3,825 ft. New pool.

Petroleum, Inc. 1 Keenan, NW NW SW 20-22s-13w. IP 34 BOPD, 50 per cent water, 30°, Lansing 3,572-78 ft. TD 3,865 ft. Opens Keenan pool.

Edwards County: Prime Drilling Co. 1 Massey, SE SE NE 3-24s-17w. IP 11 BOPD, 60 per cent water, 38°, Miss. 4,282-92 ft. TD 4,485 ft. New pool.

Sedgwick County: J. P. Gaty 2 Neuman, NW NE SE 11-25s-2e. IP 33 BOPD, 18 per cent water, Burgess 2,785-89 ft. TD 3,200 ft. Opens Neuman pool.

Kiowa County: Petroleum, Inc. 1 Becker, C SW NW 13-28s-19w. IP 2,218 M.c.f. of gas per day, Miss. 4,842-50 ft. TD 4,850 ft. New pool.

E. K. Carey Drilling Co. 1 McElwain, C NE¼ 20-28s-19w. IP 2,500 M.c.f. of gas per day, Miss. 4,920-30 ft. TD 5,060 ft. New pool.

Butler County, Strait Drilling Co. 1 Bannon, NE NW SW 16-29s-4e. IP 127 BOPD, 36°, Misener 2,856-59 ft. TD 2,871 ft. New pay in Asmusson pool.

Kingman County: Pickrell Drilling Co. 1 Swingle Hawley, SE SE SW 16-30s-9w. IP 289 M.c.f. of gas per day, 136 BOPD, 10 BWPD, 32.8°, Miss. 4,332-47 ft. TD 2,402 ft. New pool.

Harper County: Herndon Drilling Co. 1 Gerberding, SW NE NW 36-33s-6w. IP 10 BOPD, 10 per cent water, 36°, Miss. 4,461-65 ft. TD 4,933 ft. Opens Stohrbilley pool.

Sumner County: Globe Oil Co. 1 Fern King, SW NW SE 29-33s-2e. 66 per cent water, 38°, Arbuckle 3,545-53 ft. TD 3,553 ft. Opens Southwest Rudder pool.

Barber County: Honaker-Davis Drilling Co. 1 Wells, NE NE SW 18-34s-15w. IP 37 BOPD, 4 per cent water, 33.4°, 4,768-78 ft. TD 5,531 ft. Opens Wells pool.

1 Emigh, C SE NW 4-34s-11w. IP 2,050 M.c.f. of gas per day, Miss. 4,540-62 ft. TD 4,725 ft.

OKLAHOMA

Carter County: J. T. Gordin 1 Neustadt, C SE NW NE 9-1s-2w. IP 65 BOPD, 29.6°, second Bromide sand 650-658 ft. TD 1,294 ft. Bromide discovery.

Stephens County: Nelson & Spain Oil Co. 1 Dicken, C NW SW NW 1-2s-5w. IP 1,632 BOPD, 2,876-2,909 ft., Sims 3,024-30 ft. TD 3,583 ft. Humphrey zone discovery.

Anderson-Prichard Oil Corp. and Pan American Petroleum Corp. 1 Coleman, NW NE NW 14-2s-4w. IP 96 BOPD, 47°, McLish 7,618-74 ft. TD 8,006 ft. New pay discovery in Sho-Vel-Tum field.

Coal County: Carter Oil Co. et al 1 McGee "B" Unit C-764, SW NW 33-3n-9e. IPF 504 BOPD, 38°, Cromwell sand. TD 5,639 ft.

Comanche County: Kieth Walker 1 Wauh-Docah, NE NW NW 14-4n-11w. IP 5,900 M.c.f. of gas per day, McLish 2.350-2,655 ft. TD 2,990 ft.

Texas County: Cities Service Oil Co. 1 Stelzer, C NE SW 11-4n-14eCM. IP 3,000 M.c.f. of gas per day, Morrow 6,160-70 ft. TD 6,859 ft. New field.

McClain County: Skelly Oil Co. 1 Stephens, NE SW 19-5n-2w. IP 92 BOPD, 43°, Gibson 7,058-68 ft. TD 7,405 ft. Gibson zone discovery.

Superior Oil Co. 1 Walker, C SE SW 7-7n-2w. IPF 194 BOPD, Bromide sand 8,440-58 ft., Oil Creek 9,267-90 ft. TD 9,343 ft. New pay (Oil Creek) in Southwest Ladd pool.

Cleveland County: Eason Oil Co. and Chapman 1 Dollmier, 3-8n-2w. IPF 592 BOPD, 37.5°, Oil Creek 8,551-59 ft. TD 8,615 ft.

Oklahoma County: James C. Meade 1 Montie Bridges, SW SE NE 31-11n-13e. IP 4,630 M.c.f. of gas per day, 3,305-19 ft., 3,325-37 ft.; Jefferson 3,374-88 ft., 3,400-02 ft.; Wilcox 4,055-61 ft. TD 4,061 ft.

Wolfe Drilling Co. 1 Skropka, NE NW SE 12-12n-1e. IP 6,679 D.c.f. of gas per day, Misener 5,607-10 ft. (No total depth given.)

Okfuskee County: Kenwill Operating Co. 1 Unussee, SE SE NE 15-12n-9e. IPF 977 BOPD, Gilcrease 3,216-28 ft.; Cromwell 3,348-55 ft. TD 3,415 ft. New pay

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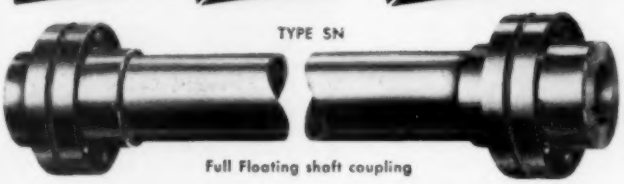

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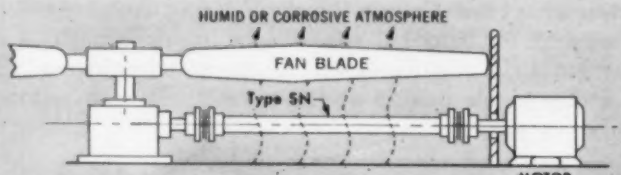

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in Gilcrease in Northeast Castle pool.

Blaine County: Gulf Oil Corp. 1 Clester, NW NW 15-18n-10w. IPF 16.8 BOPD, 62.4°, Chester 7,732-90 ft. TD 7,940 ft.

Woodward County: Pan American 1 H. E. Dean, C SW NE 3-21n-21w. IPP 48 BOPD, 12 BWPD, 38°, Tonkawa 6,629-30 ft. TD 9,257 ft. New oil pool.

Osage County: Norbla 1-A Osage, NW 14-22n-9e. IP 15 BOPD, 5 BWPD, 38°, Simpson 2,614-20 ft. TD 2,620 ft.

Ellis County: Pan American et al 1 Tune, C NW SE 35-24n-23w. IP 16,500 M.c.f. of gas per day, Morrow 7,855-56 ft., 7,862-63 ft., 7,876-77 ft. TD 8,150 ft. New field.

Woods County: The Texas Co. 1 Barker, SW SW SE 29-25n-15w. IP 3,288 M.c.f. of gas per day, Cottage Grove 5,592-5,606 ft. TD 5,644 ft. New field.

Osage County: C. W. Oliphant 1 Denoya, SW 3-25n-3e. IP 360 BOPD, 192 BWPD, 41°, Miss. chat 2,563-69½ ft. TD 3,569½ ft. New pay in Miss. Chat in Hardy pool.

TEXAS GULF COAST

Calhoun County: Plummer-Townsend-Brown 1 Henke, William P. Lewis Sur., A-102 (5 miles southwest of Port Lavaca). IP 15,000 M.c.f. daily, absolute open-flow potential, GLR 37,350 M.c.f. per barrel, 58.4°, shut-in TP 2,947 psi., perfs. 8,150½-54½ ft. (Frio-Melbourne). TD 9,016 ft. (New field.)

Live Oak County: S. H. Howell 2 Atlee Alegria, J. H. Dennis Sur., A-163 (17 miles south of George West). IP 30 BOPD, ¼-in., 48°, GOR 200 cu. ft. per barrel, TP 110 psi., perfs. 4,780-4,808 ft. (Yegua). TD 5,732 ft. (New field—2 miles north of Ramirena field.)

Matagorda County: J. S. Michael Co. 1 State Tract 449-S, Gulf of Mexico (5½ miles southeast of Sargent). IP 16,000 M.c.f. daily, open-flow potential, dry gas, shut-in TP 1,683 psi., perfs. 4,116-20 ft. TD 6,600 ft. (Extension and confirmation South Sargent offshore field.)

SOUTHWEST TEXAS

Dimmit County: Howeth & Mason et al 9 Rosa E. Crenshaw Estate, Narciso Aguirre Grant, A-1. IP 115 BOPD, 11/64-in., 32.8°, GOR 1,205 cu. ft. per barrel, TP 470 psi., perfs. 4,468-88 ft. (San Miguel). TD 5,170 ft. (New fault-flock discovery in Elaine field.)

Hidalgo County: Hydrocarbon Production Co., Inc., 15 Crain & Griffith, N. Capisallo Subd., Lot 2314, Blk. 48 (5 miles northwest of Santa Rosa). Absolute open-flow 4,100 M.c.f. daily, GLR 83.5 M.c.f. per barrel, 61°, shut-in TP 2,213 psi., perfs. 7,200-02 ft., 7,206-12 ft., and 7,227-29 ft. (Frio). TD 9,015 ft. (New pay in Lacy field.)

Starr County: Texas National Petroleum Co. 1 Garza, Sec. 156, B&M Sur., A-945 (10 miles southwest Robberson in North Rincon area). Absolute open flow 2,220 M.c.f. daily, GLR 55.5 M.c.f. per barrel, 65°, shut-in TP 2,457 psi., perfs. 7,460-72 ft. (Vicksburgh). TD 7,866 ft. (Extension discovery in North Rincon area.)

Val Verde County: H. R. Rehders, Jr., 1 Drisdale, Sec. 1, GWT&P Sur., Blk. G. IPP 20.48 BOPD, 20.7°, perforated liner 345-95 ft. (Lower Cretaceous-Paluxy). TD 419 ft. (New field—40 miles southwest of Sonora and 9 miles west of Venegarone-Strawn field, nearest production.)

Wilson County: Lone Star Producing Co. 1-A Hardin, A. Green Sur. (1 mile west of Stockdale and 13 miles northeast of Floresville). IP 133.55 BOPD, 5/32-in., 30.7 GOR 462 cu. ft. per barrel, TP 640 psi., perfs. 4,882-90 ft. (Austin chalk). TD 5,422 ft. in Edwards lime—top 5,122 ft.)

Zavala County: Pronto Drilling Co. 1-A Winterbotham, Antonio Diaz Sur. 97, A-106 (16 miles southeast of Batesville). Absolute open-flow potential 15,200 M.c.f. daily, dry gas, shut-in TP 1,727 psi., perfs. 4,288-96 ft. (Navarro-Olmos). TD 4,314 ft. (New pay in Leona River field.)

NEBRASKA

Kimball County: Lewis Bros. and Stuarco 1 Blodgett, C NE SE 18-12n-55w. IP 100 BOPD, 7 BWPD, "J" sand 6,414-20 ft. TD 6,484 ft. Opens new pool.

Reserve Petroleum Co. 1 Keefer, C NE SE 11-14n-57w. IP 90 BOPD, "J" sand 6,788-93 ft., 6,799-6,807 ft. TD 6,875 ft. Opens Keefer pool.

Skelly 1 Rodman "A," SW SW NE 17-15n-55w. IP 18 BOPD, 18 BWPD, "J" sand 6,289-93 ft. TD 6,344 ft. New pool.

Chandler & Simpson 1 Skiles, NW NW SE 34-16n-55w. IP 136 BOPD, "J" sand 6,142½-52½ ft. TD 6,219 ft. New pool.

Banner County: Petroleum, Inc. 1 Edwards, 14-18n-56w. IP 55 BOPD, 36 per cent water, "J" sand 6,248-54 ft. TD 6,325 ft. New pay in Wilson pool.

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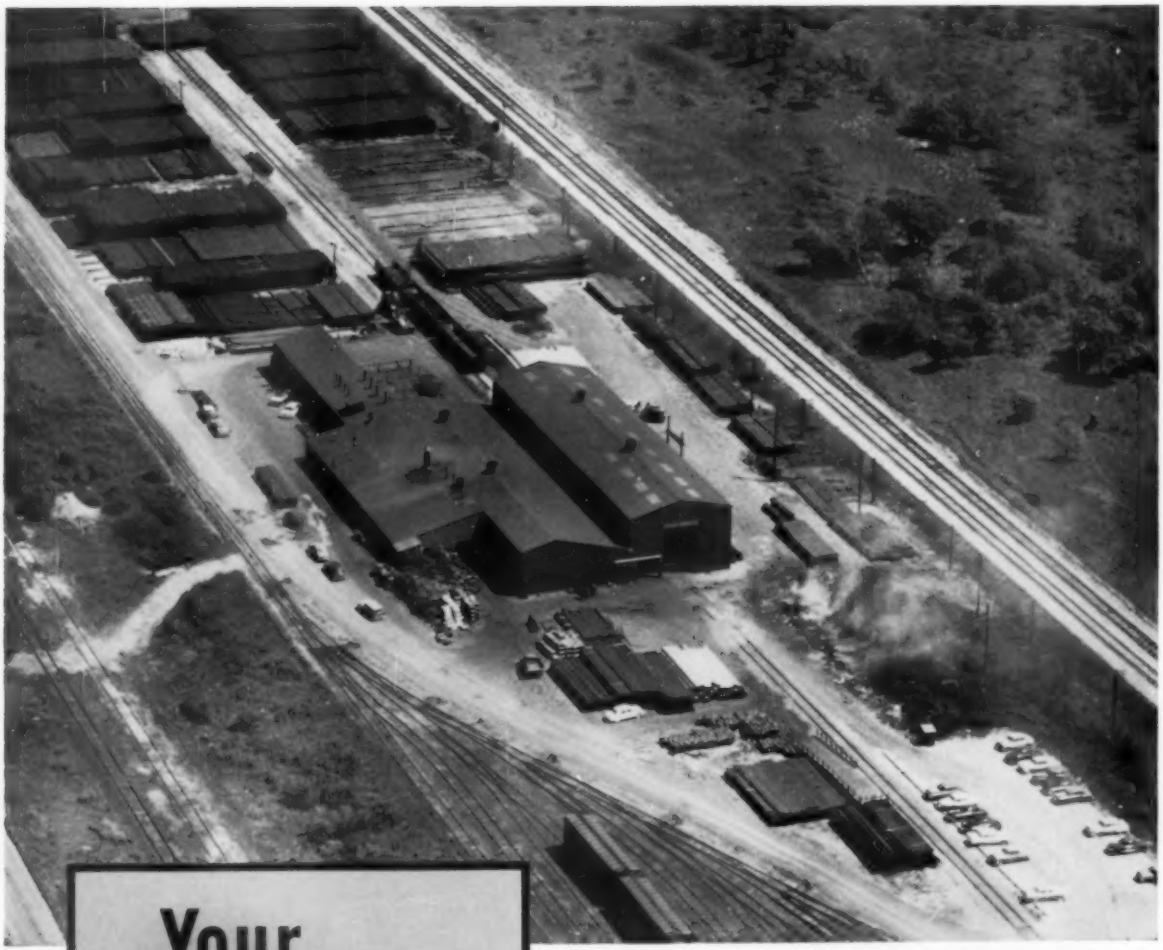

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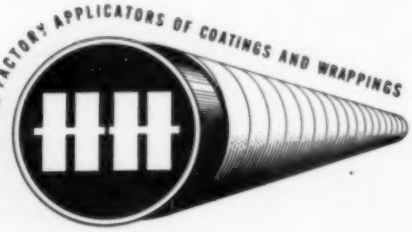

Atlantic Taps Top Geologist

. . . to head domestic production. Kraus' background and education equip him well for his upcoming assignment.

WITHIN the next few months a former mining engineer with a love for the classics and the look of a college professor will become general manager of domestic production for Atlantic Refining Co. at Dallas.

And Atlantic folk are convinced the company couldn't do better.

The upcoming new manager is 63-year-old Edgar Kraus, who just last month was promoted to assistant general manager of production from his former position of manager of the exploration division. Kraus will take over as general manager of domestic production upon the pending retirement of J. N. Mendenhall.

Kraus is peculiarly well fitted for the job, both through education and his long service with the company. Though essentially his entire 37 years of service with Atlantic have been in the exploration department, most of Kraus' decisions and actions show the thinking of an engineer as well as the geologist.

He frankly admits as strong an interest in the engineering-production side as in exploration. A partial reason for this, he thinks, is that he was trained that way.

Kraus was graduated as an engineer of mines from Columbia University School of Mines in 1917. And he worked as a mining engineer in copper mines in Michigan and Arizona until late 1918 when the mining business generally was in the doldrums after World War I.

Giving up mining as a bad deal temporarily, he headed for Eastland, Tex., during the Eastland and Ranger oil booms in 1918-19 to open a consulting office. He did surface-geological work for various oil firms, finally joining Pierce Oil Co. as a geologist in 1919. He worked for Pierce in Eastland and Houston until going with Atlantic in 1921.

He moved up steadily to district geologist, assistant to the chief geologist (after finally moving to Dallas in 1943), chief geologist in 1946, and manager of exploration in 1952.

Rock study important . . . As an exploration manager, Kraus has pounded away hard for closer integration of Atlantic's geophysical and geological efforts.

He says, too, that he "has always been a very strong advocate of detailed examination of the rock itself involving microscopic examination. I don't want to low-rate logging techniques, for these are vital to successful exploration. But fewer geologists all the time do much detailed rock examination. And I'm afraid it's becoming a lost art."

Edgar Kraus
. . . turned a hand at many things.

Oil interests broad . . . Further evidence of Kraus' engineering competence shows in the work he has done and is now doing with American Petroleum Institute committees.

He served for many years, part of the time as chairman, on the API committee charged with tackling problems dealing with well spacing and allocation of production. This was during the time when the importance of allocation wasn't generally known, and when it was generally believed that the more wells drilled the more total oil would be produced.

The work done by that committee played a large part in promoting understanding of well spacing and allocation to what it is today.

Recently the API called on Kraus again to head up a new research effort by the subcommittee on recovery efficiency of the steering committee on production practices.

The subcommittee will attempt to determine the effects of the various variables on reservoir production efficiency. It will try to devise exact mathematical relationships on the effects of such variables.

Wide off-job interests . . . Kraus' off-the-job interests are as wide as those within his vocation.

He still has a love for mining. And when uranium fever struck the country, he caught a small case of it. Though he did no active prospecting, he did do "a minor amount of rock inspecting."

His prime interest, however, which he says he hesitates to confess because he thinks it is an unusual one for an oil man, is wrapped up in music and the classical arts.

He is a talented accompanist, having accompanied several Metropolitan Opera stars in earlier years, among them Emily Hardy of San Francisco. He has organized and directed choral groups in many communities where Atlantic geological offices were located. He "never misses a performance of the symphony when I'm not out of town." And he "relishes a good ballet (but my wife can't stand it for a full evening)."

Kraus also is a lover of good food as well as music. An Atlantic associate who used to accompany him on recruiting trips said, "He always trotted me all over town to get to out-of-the-way eating spots—but then it generally was worth it."

Clint Moore has moved up from assistant superintendent of Phillips Petroleum Co.'s Smackover district, production department, to superintendent. He succeeds **C. M. Oden,** who has retired. **J. W. Russell, Jr.,** district development engineer, will succeed Moore as assistant district superintendent.

Gordon D. Kerns, formerly manufacturing coordinator with Amoco Chemicals Corp. in Chicago, has joined Vickers Petroleum Co., Inc., as senior technologist at the company's Potwin, Kans., refinery.

Charles E. Sellen, assistant manager of manufacturing for Wilshire Oil Co. of California, has moved up to manager of manufacturing at the company's Santa Fe Springs, Calif., refinery. He replaces **J. W. Whitehurst,** now with Malco Refineries, Inc., Roswell, N. M.

William S. Padon, vice president in charge of projects and planning for Warren Petroleum Corp., has been elected vice president and a director of Transwestern Pipeline Co. Transwestern is owned by Monterey Oil Co., J. H. Butler, and W. K. Warren, Tulsa.

Los Angeles Nomads Install Officers

Earl M. Daniels, right, Hydril Co., new president of the Los Angeles chapter of Nomads, is congratulated by Robert P. Gaylord, Wagner-Morehouse, Inc., outgoing president. Other new officers are Earle R. Atkins, Devex Engineering Co., vice president; Knight Templeton, S. R. Bowen Co., secretary; C. F. Van Loozen, Macco Corp., treasurer; P. M. Bowen, Martin-Decker Corp., assistant secretary; Taylor Bannerman, Technical Oil Tool Corp., assistant treasurer; H. J. Schlarb, Continental-Emsco Co., master of ceremonies; Tom R. Ashe, Globe Oil Tools Co., sergeant-at-arms; William Anderson, Pacific Perforating Co., deputy sergeant-at-arms; and Harry E. Hester, McCullough Tool Co., and Gaylord, regents.

William S. Bowden, chief process engineer for The Texas Co. in Casper, Wyo., has been promoted to chief process engineer in Tulsa.

Jerry L. Turner, trainee with The Texas Co. in Ventura, Calif., has been promoted to area petroleum engineer in Long Beach, Calif.

James D. Henry has left the University of Texas, Austin, where he was a teaching assistant, to join Atlantic Refining Co. as reservoir engineer.

Dr. Richard P. Sheldon, consulting geologist, has joined Lion Oil Co. division of Monsanto Chemical Co. in the Denver production and exploration department.

John E. Stuchell, a district superintendent for New York State Natural Gas Corp., has been named assistant to the superintendent, operations. He will headquarter in Pittsburgh.

Howard A. McKinley, land superintendent for Continental Oil Co.'s CATC marine region, has been promoted to manager of land in the foreign department. Conoco is currently operating in Egypt, Libya, British Somaliland, Somalia, Guatemala, and Venezuela. McKinley will continue to headquarter in Houston.

B. A. Moore has been transferred by Amerada Petroleum Corp. from Fairbanks, Tex., to Eunice, N. M., where he will be assistant district superintendent.

Richard L. Englum has been transferred by Ohio Oil Co. from Findlay, Ohio, where he was pipeline engineer, to Greybull, Wyo., as district pipeline engineer.

Ben D. Gould, formerly petroleum engineer for American Petrofina Co. of Texas, has joined Reiter-Foster Oil Corp. at Dallas as chief engineer and production superintendent.

Hilbert J. Nebelsiek has been appointed a project chemical engineer at the Whiting, Ind., laboratories of Standard Oil Co. (Ind.).

John Peake, formerly secretary of the Pembina Engineering Committee, has joined Canada Cities Service Petroleum Corp. in Calgary as head of the reservoir engineering department.

R. P. Burns and **F. A. Schoennagel,** junior geologists in Shell Oil Co.'s Houston office, have been promoted to geologists and transferred to Midland, Tex. **R. E. Gibson,** also junior geologist in Houston, has been transferred to Roswell, N. M., as geologist.

Personals

Robert O. Anderson has resigned as president, chairman of the board, and a director of Wilshire Oil Co. following Wilshire's purchase by Pontiac Western Corp. Anderson will remain as president and chairman of Malco Refineries, Inc.

Roland C. Fischer, engineer at Union Oil Co.'s experimental shale-oil station near Grand Valley, Colo., has been transferred to Denver where he will be field engineer.

Moody B. Robinton, foreman at United Gas Pipeline Co.'s Sugar Creek gasoline plant, Arcadia, La., has been transferred to Jackson, Miss., as dehydration plants foreman there.

P. C. Spencer, president of Sinclair Oil Corp., has been elected American Petroleum Institute treasurer succeeding **B. B. Jennings,** Socony Mobil Oil Co., who has been API treasurer since 1949. Jennings recently retired. Spencer is a former API chairman.

F. C. SMITH

F. Cushing Smith and **Dr. Lawrence A. Kimpton** have been elected directors of Standard Oil Co. (Ind.). Smith, general manager of Indiana Standard's supply and transportation department since 1955, replaces **Dr. Robert E. Wilson,** Indiana Standard chairman who is retiring, on the board. Wilson retires March 19. Kimpton, chancellor of the University of Chicago, succeeds the late Judson F. Stone.

M. M. Fidlar, vice president of Mountain Fuel Supply Co., has been named senior vice president. **Joe W. Allen,** manager of distribution, has been appointed vice president in charge of distribution. The changes follow the retirement of **J. D. Roberts,** senior vice president. Fidlar will transfer to Salt Lake City from Rock Springs, Wyo.

L. W. Stoesz, Shell Oil Co.'s division geologist in Casper, Wyo., has been promoted to Casper division exploration manager. He succeeds **C. C. Ludwick,** recently named Denver area exploration manager. Also, **Peter Lehner,** geologist in Denver, has been transferred to Casper. **Hans Widmer,** geologist, has transferred to Billings, Mont., from Casper.

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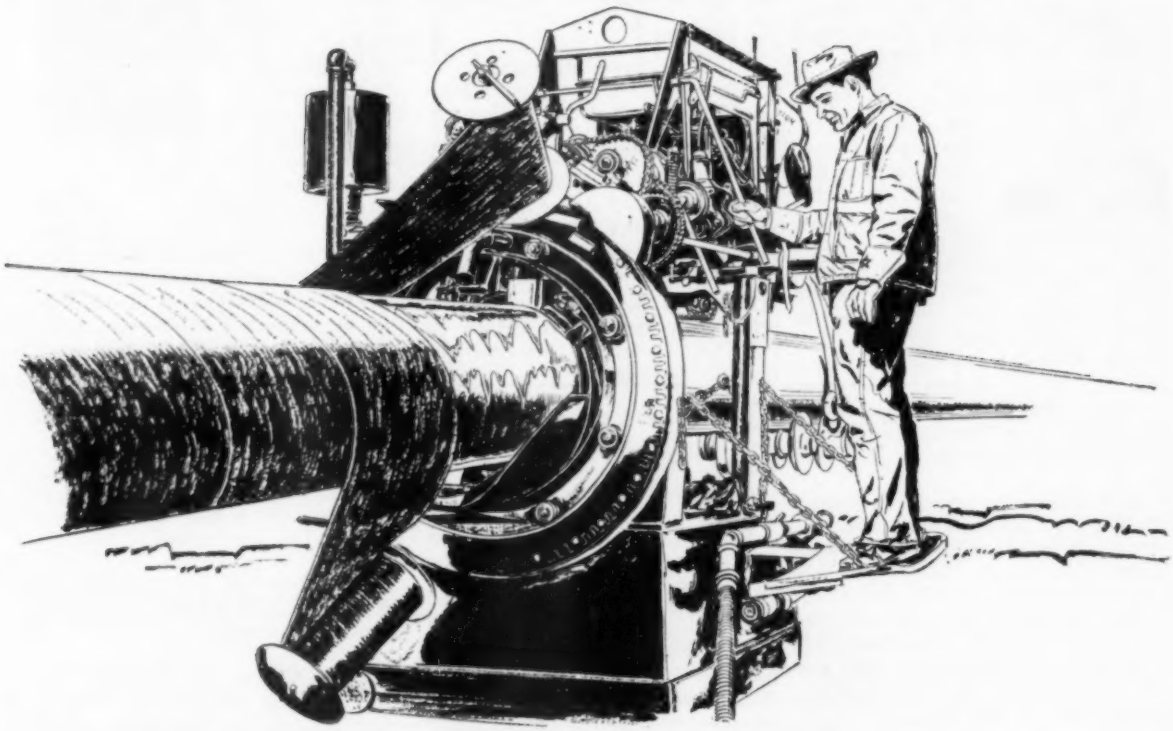

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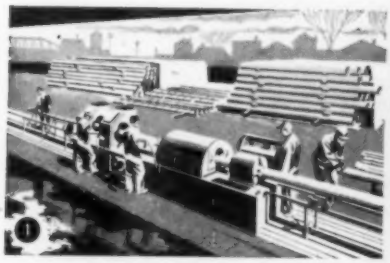

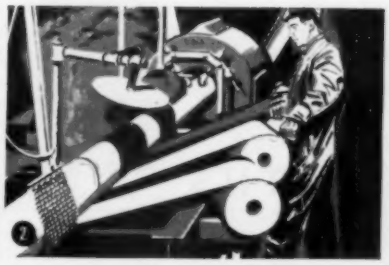

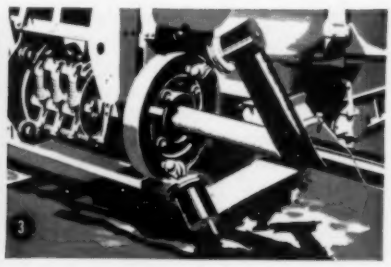

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Personals

L. O. CROCKETT

L. O. Crockett, Gulf Oil Corp. vice president in charge of petrochemicals, has been elected president and chief executive officer of Goodrich-Gulf Chemicals, Inc. He succeeds **W. I. Burt,** who becomes chairman of the board. Jointly owned by Gulf and B. F. Goodrich Co., Goodrich-Gulf is one of the nation's principal producers of synthetic rubber.

Roy A. Doman, chief engineer of New York State Natural Gas Corp., has been named manager, engineering.

E. F. Lain, tool pusher with Signal Drilling Co., has been transferred to Powell, Wyo., from Grand Junction, Colo.

D. A. Probst has resigned from the Caracas exploration department of Cia. Shell de Venezuela to join the oil and gas department of Chase Manhattan Bank in New York.

Hugh C. Williams, formerly field engineer for American Oil Co., has joined Texas Eastern Transmission Corp. in Shreveport, La., as superintendent of delivery terminals.

Harry W. Need, Jr., has been appointed a division maintenance superintendent at Du Pont's Sabine River works, Orange, Tex. **Leo Singleton, Jr.,** has been named supervisior in the electrical division there.

J. A. Warke has been named assistant coordinator of joint operations for Mobil Oil of Canada. **A. A. Halkers,** field superintendent at Weyburn, Sask., will succeed Warke as district operations superintendent in Calgary. **S. M. Thorne** has been appointed district operations superintendnt in Edmonton.

Marion K. Main, Shell Oil Co., is newly elected chairman of the Permian Basin section of Society of Petroleum Engineers of AIME. **George N. Wilson, Sr.,** Seaboard Oil Co., has been elected first vice chairman, with **Harry H. Horton,** Dowell, Inc., and **Neal McCaskill,** Atlantic Refining Co., as second vice chairman. **J. B. Markolf,** Schlumberger Well Surveying Corp., is secretary and treasurer.

R. L. Warfield has been transferred by Shell Oil Co. from Ardmore, Okla., where he was party chief, to Oklahoma City, where he will be geophysicist.

Alvan V. Brashear, manager of operations for Michigan Consolidated Gas Co., has been elected a vice president.

B. DeWitt Mitchell has been named executive vice chairman of Yucca Mining & Petroleum Co., Inc. He will headquarter in Albuquerque.

Edward T. Knudsen, supervisor of petroleum economic activities on the Pacific Coast for the Department of Interior, has retired.

D. I. Alspaw has been named petroleum engineer in Royalty, Tex., for Standard Oil Co. of Texas. He has been on military leave of absence.

R. D. Coles, Jr., exploitation engineer for Shell Oil Co., has been transferred to Farmington, N. M., from Houston.

J. T. Collins has been transferred by Gulf Oil Corp. from Beaumont, Tex., where he was field engineer, to Houston as reservoir engineer.

Gordon L. Bartholomew, development engineer, has been transferred to Ventura, Calif., from the Los Angeles office of Shell Oil Co. **Gordon L. Zenter,** development engineer, has been transferred to Shell's Los Angeles area office from Long Beach, Calif.

D. P. HANKINS

David P. Hankins, manager of Pure Oil Co.'s Heath, Ohio, refinery, has been transferred to Lemont, Ill., as manager of the company's 50,500-bbl. refinery there. Hankins is assuming a newly created position. **Willard G. Dailey,** general superintendent of the Toledo refinery, succeeds Hankins as manager at Heath. **Dale G. Miller,** general superintendent at Heath, transfers to Lemont as general superintendent. He succeeds **J. M. Lawson. Harry Hook** and **Jack N. West,** both former superintendents of operations, have been promoted to general superintendent at the Heath and Toledo refineries, respectively.

C. C. Scroggins, tool pusher with La Gloria Oil & Gas Co. in Corpus Christi, Tex., has retired.

Al Nelson has left Colorado Oil & Gas Corp. to become a consulting geologist in Denver.

James R. Crow has resigned as district geologist with Shoreline Drilling Co., Inc., to open consulting offices in New Orleans.

Geoffrey Pratt, geophysicist for British Petroleum Co., Ltd., is currently attached to the 2,000-mile trans-Atlantic expedition headed by **Dr. Vivian Fuchs.** He is making a seismic survey of the land surface under several thousand feet of ice.

DEATHS

R. G. Cocanower, 66, retired refinery manager in Oklahoma City for the old Universal Oil Co., died March 3 in Little Rock, Ark. Cocanower at one time was with Amarillo Oil & Refining Co., Great Western Oil Co., Olney Oil Co., and the Waggoner oil properties. He retired in 1946.

O. C. Dillon, 64, Victoria, Tex., area superintendent for Sunray Mid-Continent Oil Co., died February 27. Dillon was to have retired this summer.

George M. Woolley, 72, retired Sinclair Oil & Gas Co. landman, died March 1 at his home in Norman, Okla. Woolley joined Prairie Oil & Gas Co. in 1918. He later was district landman at Shawnee, Okla., Tyler, Tex., and Oklahoma City. He retired in 1948.

Jack Benninghoff, 83, retired drilling contractor, died recently in Tulsa. Benninghoff organized his drilling firm in 1916. He retired in 1940.

O. F. Moore, 68, Findlay, Ohio, retired director and vice president of Ohio Oil Co., died recently in Rankin, Tex., after a heart attack.

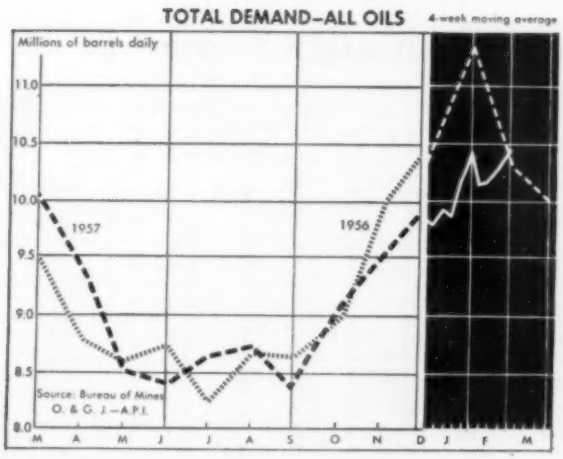
James D. Hawk, 74, pioneer in development of California's Signal Hill field, died February 25 in St. Louis.

Henry S. Severson, 50, Tulsa independent operator, died recently in Fort Smith, Ark.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,847,325	UP	17,400	DOWN	622,866
Crude stocks	284,966,000	UP	207,000	UP	33,282,000
Completions	797	DOWN	131	DOWN	237
Refinery runs	7,560,000	UP	54,000	DOWN	516,000
Gasoline stocks	215,191,000	UP	2,075,000	UP	11,417,000
Kerosine stocks	17,167,000	DOWN	1,429,000	DOWN	4,302,000
Distillate stocks	88,638,000	DOWN	8,030,000	UP	2,940,000
Residual stocks	54,208,000	DOWN	1,227,000	UP	16,244,000
Four-product stocks	375,204,000	DOWN	8,611,000	UP	26,299,000
Total imports	1,712,500	UP	631,800	UP	417,200



Petroleum Product Markets Are Waiting for Spring

PETROLEUM PRODUCT markets are becalmed in the period of changing seasons. The winter period of home heating has more than a month to run, but this month will be one of declining demand. The coldest weather of the winter came in the middle of February when many suppliers were making plans for the change-over from winter operations to spring schedules.

Many refiners, particularly in Gulf-East Coast areas, were beginning to worry about surplus distillate stocks that would be left over at the end of the season. Extra sales during the cold period brought sharp reductions in distillate stocks but not enough to solve the overage problem for some refiners.

Total distillate stocks in the Gulf-East Coast refining districts amounted to 43,549,000 bbl. on February 28 compared with 41,799,000 bbl. at the same time last year and with 35,951,000 bbl. at the end of February 1956.

Distillate stocks in PAD District 2 are 2,000,000 bbl. below last year. But, this year's level can be considered about normal since the total at the end of February 1957 was a little high. However, the distribution within the district was such that extra sales during the cold period almost depleted stocks at some pipeline terminals.

Surplus distillate stocks on the Gulf Coast have influenced prices in District 2. During the Suez crisis, cargo prices on the Gulf Coast were as much as 1.00 cent a gallon above Group 3 spot prices. Even as late as July 1957, Gulf Coast prices were 0.25 cent a gallon higher than Mid-Continent.

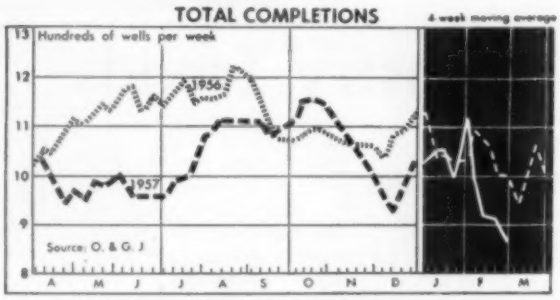
Early in December, Group 3 prices advanced to 8.875 cents a gallon for No. 2 but gradually dropped back as the Gulf Coast market weakened. Even after withdrawals during the 2-week period of cold weather, No. 2 is available on the Group 3 market at 8.50 cents and on the Gulf Coast at 8.25 cents.

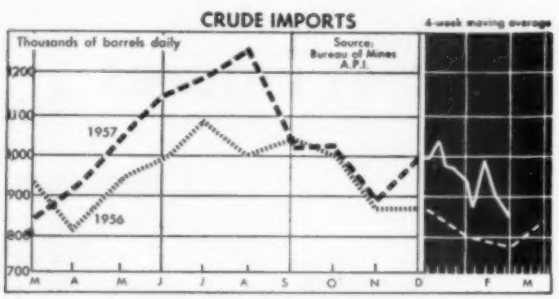
Several companies have followed Gulf Oil Corp. in adjusting gasoline prices in some of the price-war areas in the upper part of the East Coast. In many cases, prices announced by other companies did not follow Gulf's posting exactly, but these differences will be adjusted by market competition in the areas.

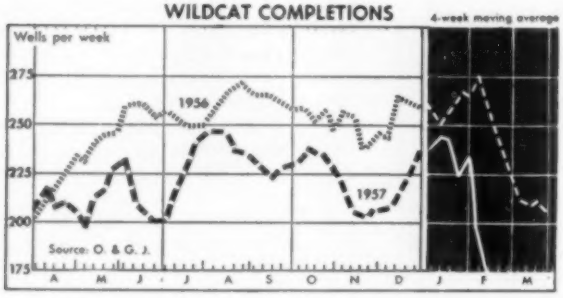
Most suppliers agree that gasoline stocks are too high, but there is a possibility that at least part of the necessary adjustment can be made in March. Crude production will be at least 550,000 bbl. daily less than in February which will give refiners a chance to make further cuts in refinery runs.

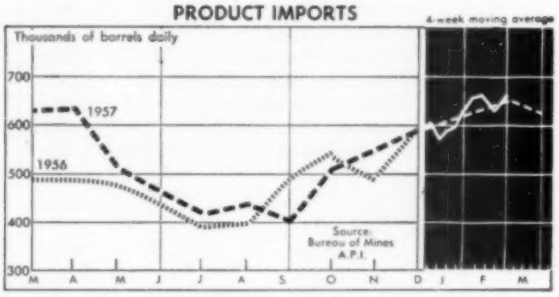
Heavy fuel in the Group 3 area is firming slightly. The price is low enough to compete with gas as refinery fuel in the Southwest, and asphalt production will start soon.

Pennsylvania Grade crude was cut 25 cents a barrel with latest posting effective February 3.







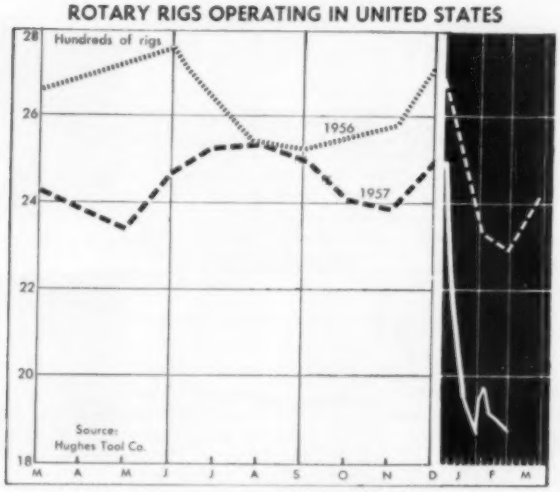


WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 1, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	14	11	0	0	0	0	0	6	5
Arkansas	10	4	0	0	6	0	38,609	121	177	3	1	0	0	2	25	26
California	33	26	0	0	7	0	153,889	344	358	3	0	0	0	3	60	96
Colorado	16	3	0	2	11	0	79,515	124	204	8	1	0	0	7	69	136
Illinois	29	9	0	0	20	0	73,362	340	431	3	0	0	0	3	63	101
Indiana	23	5	0	4	14	0	31,135	122	118	10	1	0	2	7	41	22
Kansas	63	28	0	3	29	3	217,511	634	732	10	2	0	1	7	133	131
Kentucky	14	7	0	0	7	0	15,717	146	253	2	0	0	0	2	17	58
Louisiana	41	17	2	4	18	0	347,389	549	651	7	0	0	0	7	69	111
North	14	7	0	3	4	0	34,949	183	254	1	0	0	0	1	27	31
South	22	7	2	1	12	0	258,929	289	288	6	0	0	0	6	39	66
Offshore	5	3	0	0	2	0	53,511	77	109	0	0	0	0	0	3	14
Michigan	3	2	0	0	1	0	10,000	53	67	1	0	0	0	1	19	28
Mississippi	4	1	2	0	1	0	35,057	73	53	1	0	0	0	1	41	25
Montana	10	4	0	0	6	0	31,557	77	54	3	0	0	0	3	39	20
Nebraska	13	4	0	0	9	0	69,788	114	134	4	2	0	0	2	53	76
New Mexico	28	21	0	2	5	0	146,515	391	341	4	0	0	0	4	63	58
West	14	8	0	2	4	0	64,410	196	124	4	0	0	0	4	32	21
East	14	13	0	0	1	0	82,105	195	217	0	0	0	0	0	31	37
New York	10	5	0	0	0	5	13,500	95	.....	0	0	0	0	0	5	.....
North Dakota	4	1	0	0	3	0	38,635	70	60	1	0	0	0	1	25	25
Ohio	19	7	0	6	3	3	56,475	156	178	0	0	0	0	0	3	3
Oklahoma	108	53	3	7	42	3	396,436	1,221	1,184	10	2	0	0	8	172	136
Pennsylvania	0	0	0	0	0	0	0	17	*49	0	0	0	0	0	2	*18
Texas	343	198	10	18	115	2	1,499,707	3,257	3,857	72	7	0	1	64	701	1,099
District 1	20	5	0	4	10	1	54,725	165	198	7	0	0	0	7	69	80
District 2	11	3	2	2	4	0	68,043	100	126	2	0	0	1	1	26	59
District 3	16	9	1	1	5	0	112,244	217	333	3	0	0	0	3	36	111
District 4	16	8	1	1	6	0	74,530	205	261	4	1	0	0	3	69	103
East	26	7	1	0	18	0	124,938	245	227	13	0	0	0	13	72	67
District 7-B	37	16	0	0	21	0	131,859	396	521	15	2	0	0	13	131	198
West	120	100	2	1	16	1	601,980	988	1,004	9	1	0	0	8	148	170
District 9	65	32	0	3	30	0	184,136	699	917	17	3	0	0	14	128	285
District 10	32	18	3	6	5	0	147,252	242	270	2	0	0	0	2	22	26
Utah	12	6	0	1	5	0	68,005	79	24	3	0	0	0	3	14	12
West Virginia	4	0	0	4	0	0	11,910	125	117	0	0	0	0	0	4	8
Wyoming	9	3	0	1	5	0	48,426	123	137	3	0	0	1	2	50	51
Miscellaneous (Wash.)	1	0	0	0	1	0	5,125	22	15	1	0	0	0	1	17	9
Total U. S.	**797**	404	17	52	308	16	3,388,263	8,267	9,205	**149**	16	0	5	128	1,691	2,254
Total prev. week	928	460	24	72	363	9	3,945,261	.....	.....	192	15	5	5	167	.....	.....
Cum. 1958	8,267	4,132	191	621	3,153	170	34,914,271	.....	.....	1,691	154	21	69	1,447	.....	.....
Western Canada	50	30	....	5	15	....	250,000	403	398	0	0	0	0	0	116	97

*Incl. New York.

ROTARY RIGS OPERATING IN UNITED STATES



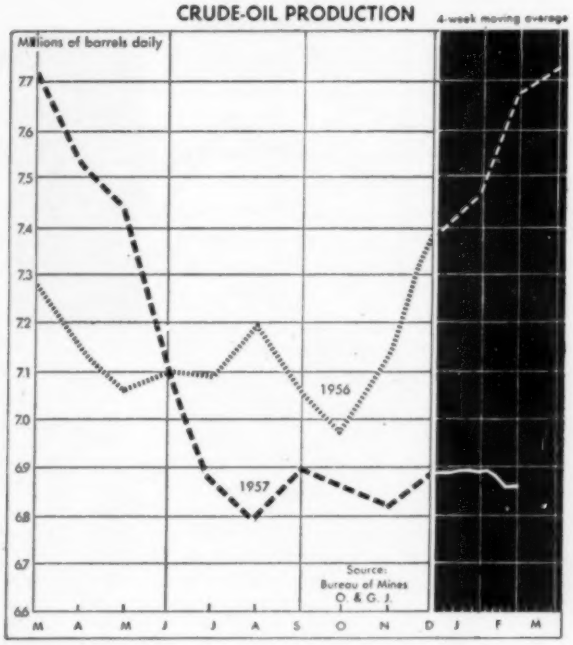
ACTIVE ROTARY RIGS*

	3-3-58	2-24-58	2-17-58	3-4-57
Alabama	6	7	8	13
Arkansas	20	22	22	16
Arizona	1	1	1	...
California	85	85	82	94
Colorado	29	26	37	43
Florida	2	2	1	2
Georgia	...	...	...	...
Idaho	...	...	...	...
Illinois	39	47	42	46
Indiana	1	7	5	1
Iowa	3	3	3	1
Kansas	100	117	121	162
Kentucky	3	4	9	4
Louisiana	324	327	325	438
North	30	30	31	46
South	234	231	232	285
Offshore	60	66	62	107
Maryland	...	...	...	1
Michigan	7	9	9	12
Missouri	...	...	...	...
Montana	25	26	27	30
Mississippi	43	40	41	21
Nebraska	22	19	20	27
Nevada	...	...	...	...
New Mexico	106	109	108	117
New York	1	1	1	1
North Dakota	32	29	34	23
Ohio	1	1	2	...
Oklahoma	187	182	186	245
Oregon	...	...	...	1
Pennsylvania	10	10	12	11
South Dakota	...	...	...	3
Texas	733	727	718	1,011
Gulf Coast	142	153	154	225
Offshore	...	2	4	7
West	308	305	307	383
North	244	223	209	336
East	39	44	44	60
Tennessee	...	...	...	...
Utah	42	42	40	35
Washington	...	...	...	1
West Virginia	4	4	4	1
Wyoming	43	50	53	49
Virginia	...	...	...	...
Total United States	1,869	1,897	1,911	2,409
Western Canada	240	237	241	244
Eastern Canada	...	...	...	...
Grand total	2,109	2,134	2,152	2,653

*Hughes Tool Co.

CRUDE-OIL PRODUCTION

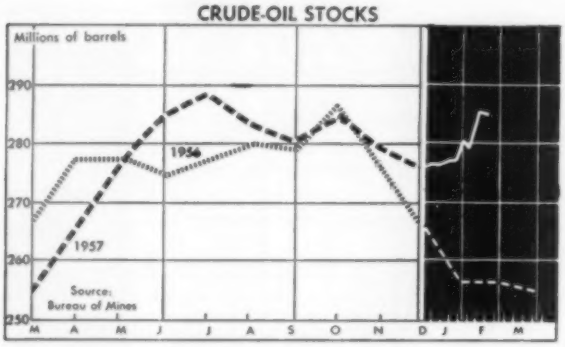
4-week moving average

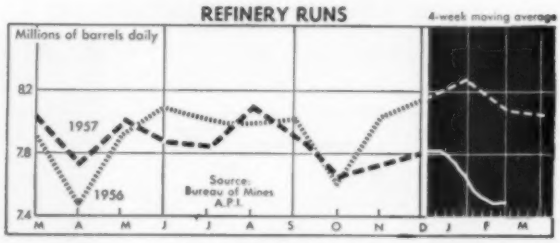


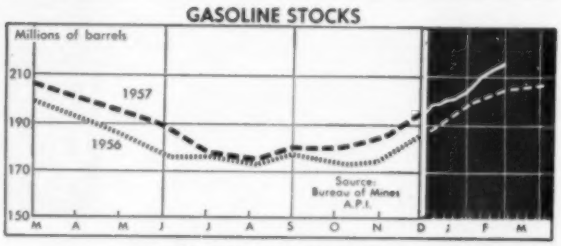
DAILY AVERAGE PRODUCTION FOR WEEK

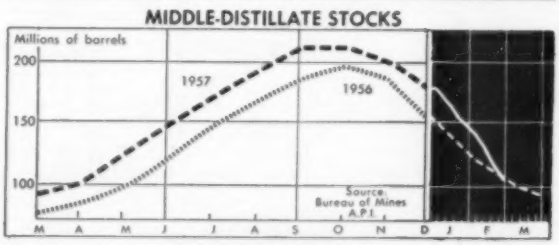
	March 1, 1958			Feb. 22
	Crude oil	Lease condensate	Total	total
Alabama	15,950	...	15,950	15,925
Arkansas	82,800	200	83,000	83,625
California	889,300	...	889,300	897,300
Colorado	141,500	...	141,500	141,550
Eastern	48,900	...	48,900	49,600
Florida	1,275	...	1,275	1,275
Illinois	228,300	...	228,300	232,500
Indiana	30,500	...	30,500	31,200
Kansas	†332,400	...	†332,400	†331,350
Kentucky	40,500	...	40,500	40,500
Louisiana	761,600	96,100	857,700	851,050
North	111,800	2,800	114,600	107,950
South	649,800	93,300	743,100	743,100
Michigan	25,200	...	25,200	26,400
Mississippi	98,900	4,950	103,850	103,850
Montana	74,350	...	74,350	74,300
Nebraska	52,800	...	52,800	54,100
Nevada	150	...	150	150
New Mexico	260,150	5,900	266,050	266,050
North Dakota	38,100	...	38,100	37,050
Oklahoma	†570,400	...	†570,400	†547,500
Texas	2,660,000	62,150	2,722,150	2,722,150
Dist. 1	48,000	475	48,475	48,475
Dist. 2	122,000	9,125	131,125	131,125
Dist. 3	371,000	31,000	402,000	402,000
Dist. 4	199,000	7,500	206,500	206,500
Dist. 5	35,000	500	35,500	35,500
Dist. 6	122,000	7,000	129,000	129,000
East Texas Field	164,000	...	164,000	164,000
Dist. 7-B	148,000	150	148,150	148,150
Dist. 7-C	143,000	3,650	146,650	146,650
Dist. 8	1,000,000	1,500	1,001,500	1,001,500
Dist. 9	201,000	600	201,600	201,600
Dist. 10	107,000	650	107,650	107,650
Utah	16,200	...	16,200	14,750
Wyoming	308,550	...	308,550	307,550
Others	‡200	...	‡200	‡200
Total U. S.	6,678,025	169,300	**6,847,325**	6,829,925
Change from previous week, up			**17,400**	
Canada	†520,200	...	†520,200	†528,960
Total U. S. production—Jan. 1-March 1				412,224,590 bbl.
Same period last year (crude plus cond.)				*454,449,187 bbl.

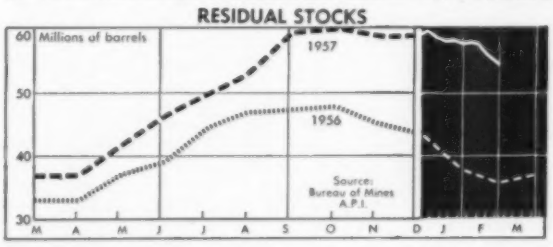
*Includes 8,779,425 bbl. condensate. †Week ended previous Monday. ‡South Dakota.











CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-22-58	2-15-58	2-23-57
Pennsylvania Grade	2,803	2,805	2,503
Other Appalachian	1,627	1,527	2,045
Illinois, Indiana, and Michigan	10,957	11,380	9,783
Nebraska and North Dakota	2,608	2,413	1,988
Kansas	9,409	9,602	9,343
Oklahoma	19,329	18,838	20,535
Arkansas	3,056	2,964	2,405
Louisiana	20,187	20,234	18,902
North	3,306	3,332	2,748
South	16,881	16,902	16,154
Mississippi, Alabama, and Florida	2,892	2,699	2,093
New Mexico	9,068	9,344	7,319
Texas	126,418	124,829	114,604
East Texas	9,202	9,500	10,420
West Texas	56,089	55,164	54,229
Texas Gulf	26,345	26,629	20,942
Other Texas	34,782	33,536	29,013
Wyoming	14,101	14,442	16,030
Other Rocky Mountain	6,926	7,028	5,902
California	38,639	38,000	26,915
Foreign	†16,946	18,654	11,317
Total	284,966	284,759	251,684

*Bureau of Mines. Includes 5,307,000 bbl. in California.

API REFINERY REPORT—FEBRUARY 28, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,118	443.6	46.6	333.9	210.1	43,663	7,351	29,055	10,066	1,176	479.2	39.9	333.5	212.6
Appalachian:														
District 1	95	36.1	5.8	18.3	11.6	5,213	460	1,896	550	100	39.3	6.1	24.2	8.0
District 2	117	58.7	3.7	29.7	13.0	3,044	257	589	452	111	56.9	7.1	21.7	16.6
Ind., Ill., Ky.	1,409	699.7	70.6	356.4	189.4	39,062	3,571	11,478	4,273	1,466	706.1	71.3	340.2	209.8
Minn., Wis., Dak.	110	52.4	6.0	23.7	14.6	7,164	590	3,890	410	103	50.5	6.3	27.0	12.0
Okla., Kans., Mo.	725	411.4	24.4	169.2	29.4	20,681	791	6,969	954	689	379.9	15.0	172.5	44.8
Inland Texas	267	204.2	5.9	54.1	26.0	9,196	342	1,421	2,086	270	186.5	7.9	51.7	23.0
Texas Gulf Coast	1,733	912.4	140.0	442.3	179.3	31,381	1,554	9,451	4,907	1,945	879.9	121.5	580.5	242.6
La. Gulf Coast	587	337.4	75.1	117.4	45.1	12,961	1,050	5,043	1,142	685	329.5	62.0	207.2	52.7
N. La. and Ark.	94	29.6	9.7	24.3	7.7	5,677	527	1,776	99	96	37.1	7.3	25.9	7.0
Rocky Mountain:														
New Mexico	30	14.7	1.0	7.1	3.6	426	17	129	89	28	14.3	0.5	5.2	3.5
Other Rocky Mt.	264	132.3	5.7	58.9	34.9	7,952	298	2,609	887	286	135.1	2.5	68.4	42.3
West Coast	1,011	486.2	1.9	101.1	390.6	28,771	359	14,332	28,293	1,133	494.6	5.2	176.6	394.6
Feb. 28, 1958	7,560	3,818.7	396.4	1,736.4	1,074.3	215,191	17,167	88,638	54,208	8,088	3,788.9	352.6	2,034.6	1,269.5
Feb. 21, 1958	7,506	3,705.3	338.0	1,715.4	1,109.9	§213,116	18,596	96,668	55,435	.....	.....	.....	.....	.....
March 1, 1957	8,076	3,817.6	358.0	2,025.0	1,226.0	203,774	21,469	85,698	37,964	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.25-11.75
Premium (98 octane)	14.00-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.00-10.50
Regular (92 octane)	10.25-10.50
Premium (97 octane)	11.75-12.00
Premium (98 octane)	12.00-12.50
California (rack) (Los Angeles):	
Regular (88 octane)	12.2
Premium (96 octane)	14.5
Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (93 octane)	10.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-9.75
Diesel oil (58 d.i. and above)	9.125-9.50
Distillate No. 1	9.125-9.50
Distillate No. 2	8.50-8.75
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.25-8.50
New York Harbor (barges):	
Kerosine 41-43	10.35
Distillate No. 2	9.65-9.85
Diesel fuel, 48-52 d.i.	10.25
Caribbean area (cargoes):	
Distillate No. 2	8.50

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.20-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.25-2.50
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C	$2.35
California (rack):	
Bunker C fuel, Los Angeles	$2.65-2.80

LUBRICATING OILS

Mid-Continent (Group 3):	
★ 150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
★ 200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
★ 145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
★ 200 vis. neutral (180° at 100°), 25 p.t.	24

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour) (§)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.81
16-16.9	2.74	....	....	....	1.86
17-17.9	2.78	....	....	....	1.91
18-18.9	2.82	....	....	....	1.96
19-19.9	2.85	....	....	....	2.01
20-20.9	2.89	$2.75	....	$2.62	2.06
21-21.9	2.93	2.77	....	2.64	2.11
22-22.9	2.97	2.79	....	2.66	2.16
23-23.9	3.01	2.81	$3.44	2.68	2.21
24-24.9	3.05	2.83	3.46	2.70	2.26
25-25.9	3.09	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour. §Some heavy Wyoming sour posted at 8 cents less.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, Feb. 3, 1958.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
★ Bradford	4.40
★ Middle District	4.22
★ Southwest Pennsylvania	3.93
★ West Virginia	3.75
★ Buckeye Grade	3.75
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.74
Redwater (Alta.)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25-2.38
Bachaquero, flat, Las Piedras*	2.03-2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-U.S.N.H., dirty (USMC—32.5%)	$1.92
Gulf-U.S.N.H., clean (USMC—10%)	2.57
Carib.-U.S.N.H., dirty (USMC—55%)	1.22
Carib.-U.S.N.H., clean (USMC—10%)	2.43

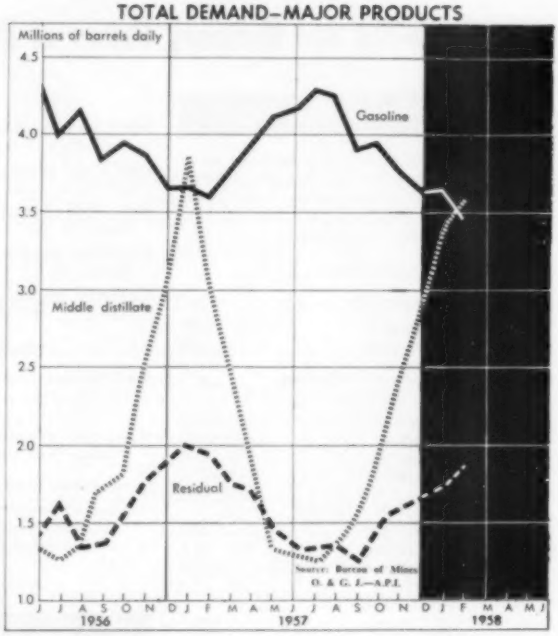
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

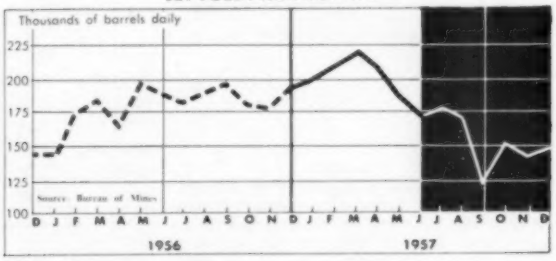
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
February 1958*	3,460	3,760	215,200
January 1958*	3,650	3,830	205,060
December 1957	3,702	4,001	196,776
March 1957	3,783	3,743	206,716
February 1957	3,597	3,789	205,270
KEROSINE			
February 1958*	580	370	17,200
January 1958*	540	360	22,950
December 1957	474	356	29,200
March 1957	363	332	20,223
February 1957	467	353	21,013
DISTILLATE			
February 1958*	2,995	1,720	88,500
January 1958*	2,790	1,860	122,325
December 1957	2,474	1,886	149,449
March 1957	2,182	1,861	76,245
February 1957	2,620	2,035	85,105
RESIDUAL			
February 1958*	1,850	1,085	54,200
January 1958*	1,720	1,070	57,520
December 1957	1,774	1,142	59,959
March 1957	1,748	1,205	37,371
February 1957	1,946	1,269	36,201

*Preliminary. †Thousands of barrels.

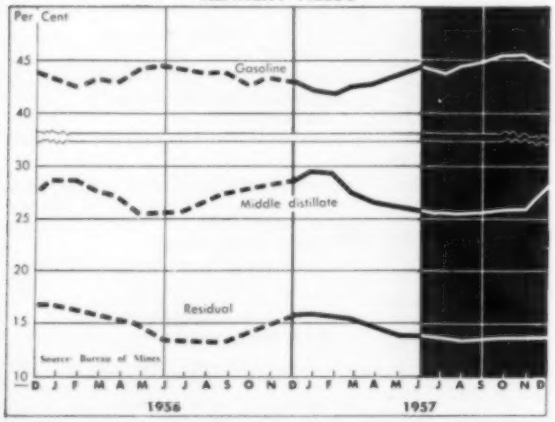
TOTAL DEMAND–MAJOR PRODUCTS



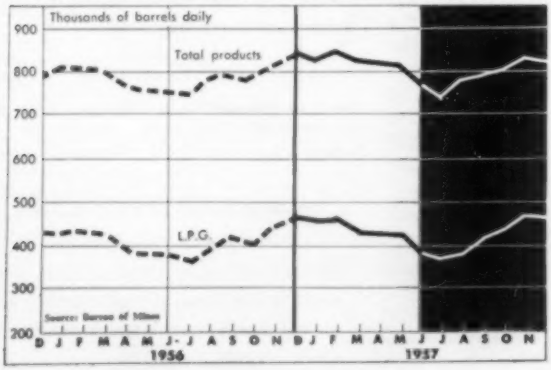
JET-FUEL PRODUCTION



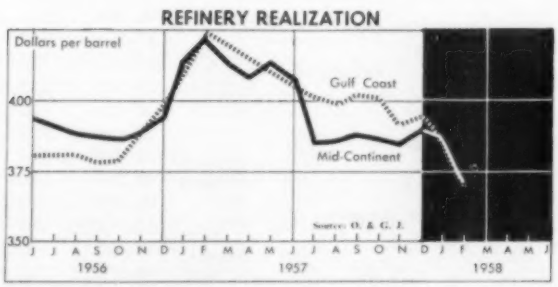
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Feb.* 1958	Jan.* 1958	Dec. 1957	Feb. 1957
Mid-Continent	$3.71	$3.83	$3.86	$4.23
Gulf Coast	3.70	3.84	3.91	4.24

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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FOR SALE EQUIPMENT

MAYHEW SHOT HOLE Drill and Drill Tender. Good condition. Sacrifice. Tom Purcell, 2220 Adolphus Tower, Dallas, Texas. RI 2-4257.

WALKER-NEER SPUDDER—Model S-43. New Lines, 5" and 6" tools. Complete equipment for completion work.—Bandy Drilling Company, Cushing, Oklahoma.

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2—29" x 15" LVG, Ser. #2T220 and #2T221, Type 104K, 75# W.P.
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1—8" x 14" Part #C52-14-DK, Class C5A, Ser. #12488. (Cylinder Liner)
1—8" Piston, Part #CA-24-EK for Cooper-Bessemer, Class C5A.
2—23½" x 14" Ser. #4730 and #4731, Class CE14, Suction 0#, Discharge 40#.
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1—19½" x 20" Ser. #6240, Class D-20, 75# W.P.
3—23" x 15" **LTC WORTHINGTON COMPRESSOR CYLINDERS**, 75# W.P.
2—14" x 36" **SNOW COMPRESSOR CYLINDERS**, 325# W.P.
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Valves: Steel & SS ½" through 6"
Furnaces: Petro-Chem, ½, ¾ mil. BTU-HR.

HEAT EXCHANGERS
Steel Tube: 1000, 900, 650, 500, 300, 200 sq. ft.
Adm. Tube: 2250, 2200, 1300, 900, 740, 625, 300 sq. ft.
S.S. Tube: 1228, 947, 570, 536, 380, 315, 250, 157 sq. ft.
4-6% Chr. Tube: 1000, 500 sq. ft.
Fin Tube: 73, 21, 11 sq. ft.

PUMPS
Hot-Oil: 324 gpm @ 4600'; 735 gpm @ 3100'; 400 gpm @ 2000'; 1270 gpm @ 400'.
Water: 10,500 gpm @ 135'

COMPRESSORS
Worth.: LTC-6, Gas Engine, 800 hp.
Penna.: 100 CFM @ 500#; 365 CFM @ 100#

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FOR SALE at Bartlesville, one Mayhew 1000 heavy duty all purpose drill 5"x6" Wheatley pump, 23' Kelly, 25' mast mounted on 1951 Ford truck, 6 cylinder, 158" chassis. Unit bought new November 1946, truck March 1951. Price $6500.00. Cities Service Oil Company—Patridge, Bartlesville.

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NEW CASING AND TUBING

4½"	F-25, 9.5# LW	32,000'
2"	F-25, Non EUE 4.6# LW	50,000'
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ROTARY, 17¼" IDECO; Swivel Emsco 100T; Drill Collar 32' x 6¼". Box K-595, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE at our Chase and Russell, Kansas warehouses, 2—Model CD and 1—Model AB National Tank Portable Batch Treaters mounted on skids. Cities Service Oil—Patridge, Bartlesville.

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2'6" x 30'0"	270 PSI Packed

REGENERATION AIR BLOWER, 11,000 CFM, 11 PSIG, Turbine Driven.

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All Steel U-Tube Bundles, Sq. Ft. Area: 947; 705; 220; 165.

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2600	75 PSI	200 HP Motor
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KILN 18'-6¼" ID x 55'8" OA

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1 Motor & 1 Turbine Driven

(4) 1½" x 2" Two Stage (4) 1½" x 2½" Two Stage
(8) 2" x 3" (4) 3" x 4" (2) 4" x 6"

REACTOR, Stainless Steel Lined, 14'0" ID x 44'2" OA

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12 x 5 x 12 (2)	7½ x 4 x 10 (2)
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8 x 4 x 6 (5)	4½ x 4 x 6 (1)
Hot Oil 6 x 4 x 6 (3)	

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5,000 bbl. Cone (3)	2,500 bbl. Cone
1,800 bbl. Cone (2)	1,800 bbl. Cone (12)
1,500 bbl. Cone (2)	1,500 bbl. Cone (2)
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10,000 Bbl. Welded HORTON SPHEROID

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1956 FAILING 1500 truck mounted. 5x6 G-D pump, 38' mast, pipe and auxiliary equipment. Also 1955 I-R 600 Gyroflo compressor, truck mounted. Richard Travis, 615 North First, Phone CHapel 2-8331, Grand Junction, Colorado.

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1—140'x40'x8'9" Deck Cargo & Oil Well Testing Barge. 1150 Tons—6,500 Barrels.

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WILL TRADE. 8 unit Tourist Court with 5 room living quarters and office, corner location on Main Hi-way, 3 blocks from Court House Hill County, fishing, hunting in Burnet, Texas. For complete Portable Rotary Rig with drill pipe, Franks, Joy, etc. 3500 ft. capacity or over, in top condition. Ogden B. Klein—P. O. Box 464, Taylor, Texas.

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PETROLEUM ENGINEER. Expanding Independent Company has immediate opening for Petroleum Engineer to take over secondary recovery operations. Must be experienced and capable of assuming full responsibility for lay-out of well system, plant design, drilling and completion of wells and operation of water flood. Must have a practical approach to problems based on actual experience. Location Southwest. Arrangements will be made for interview. Box K-592, The Oil and Gas Journal, Tulsa, Oklahoma.

OPERATIONS SUPERINTENDENT—Opening in medium sized natural gas utility in Midwest for an able Graduate Engineer or equivalent to supervise construction, maintenance, service on customer premises, appliance installation, metering, pressure regulation and planning system expansion. Liberal benefits. Salary commensurate with experience and ability. State personal and educational qualifications. Box K-581, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT Oil Company at Winnipeg, Manitoba, has opening for a shift foreman with 8 - 10 years' refinery experience in crude, vacuum, fluid catalytic cracking, gas recovery and cat poly unit operations. Refinery crude capacity is 12,000 barrels/day. In reply give summary of education and experience, salary expected, and date available. Write to: North Star Oil, Ltd. Box 139, St. Boniface, Manitoba. Personnel Department.

EVALUATION ENGINEER

Oil Company has immediate opening for graduate Engineer with a minimum of 3 years refinery experience in either operations or maintenance. Prefer experience to be along lines of estimating and appraisal. Maximum age, 35. Major can be either M.E., P.E., or Ch.E. Submit complete resume in confidence.

Box K-579,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

WANTED FOR foreign employment in North Africa and Middle East with independent drilling contractor, tool pushers, mud engineers, rotary and cable tool drillers, diesel mechanics, truck pushers. Must be qualified. Box K-567, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT

Middle East independent producer has opening for refinery superintendent with 10 to 15 years experience to supervise operation and maintenance new 30,000 BPD plant. Individual selected should be between 35-50 with ability coordinate American and foreign personnel. Resume and details should be addressed:

Box K-571,
The Oil and Gas Journal,
Tulsa, Oklahoma.

STATISTICIAN

Detroit research laboratories has opening in statistical planning group. Requires person with MS or PhD. degree in statistics and two to five years' industrial experience in engineering, chemical or physical applications. Principal duties involve the planning and analysis of experimental work of a diverse nature encountered in our automotive and chemical research laboratories. The data are often characterized by high variability and high cost. A small digital computer is available to the group. For more particulars write to:

PERSONNEL MANAGER
Ethyl Corporation
Research Laboratories
1600 W. Eight Mile Road
Ferndale 20, Michigan

THE NATIONAL IRANIAN OIL COMPANY

has vacancy for a fully qualified engineer to develop plans and projects for major work such as pipeline, oil refineries, production and distribution installations, loading terminals, etc. and to supervise execution of such plans. Applicants must be corporate member of either Inst. Civil Engrs. or Inst. Mech. Engrs. or equivalent, also Fellow of British Petroleum Inst. or equivalent. Age limit 55 with 5 - 10 years in full control of engineering work related to petroleum industry. Salary commensurate with qualifications and experience. Two year contract with possibility of extension. Write, giving full details of particulars and experience, to

THE EMBASSY OF IRAN,
3005 Massachusetts Avenue, N.W.,
Washington 8, D. C.

HELP WANTED

MANUFACTURERS Representative for proven line of engine protective equipment. Several territories open. Box K-573, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GRADUATE PETROLEUM ENGINEER, 38, married, 14 years experience in drilling, production, well tests, workovers, and valuations. Now chief engineer overseas. Desire responsible position. Box K-568, The Oil and Gas Journal, Tulsa, Oklahoma.

CONTACT MAN - SALES ENGINEER. Eighteen years experience including work in Venezuela, Trinidad, Peru, Colombia. Box K-591, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, ten years well logging & subsurface experience in oil and uranium. Wishes to relocate. Prefer Rocky Mountains. Box K-590, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER-Ph.D. Chemical Engineer. Eight years wide experience in process engineering and design of petroleum and petrochemical facilities. Strong basic and practical background. Seeks responsible position in process engineering for petrochemical or petroleum company. Southwest preferred. Age 38, family. Box K-594, The Oil and Gas Journal, Tulsa, Oklahoma.

YOUNG MAN, 29, with background in oil finance and mineral economics wishes to join independent oil company as administrative assistant or similar position. M.S. Mineral Economics. Resume on request. Box K-588, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: 29, family, four years diversified experience oil and gas production, gas processing and transmission. Obtaining MBA degree in June, available late June. Desire Administrative position requiring Engineering knowledge with independent producer. Box K-589, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN, 31 years of age having 8 years extensive experience in all phases of land work with one of major producing companies in Rocky Mountain Region desires to relocate in same region with Independent or aggressive Major. Box K-577, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER. Twelve years experience major companies in design, construction and operation of gas processing plants, including pipeline facilities. Supervisory experience. Desire position in Texas with medium size company, independent or contractor. Box K-539, The Oil and Gas Journal, Tulsa, Oklahoma.

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Delaware Corporation formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

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TECHNICAL LIBRARY. Belonged to the late Dr. Byron B. Boatright, petroleum and gas consulting engineer. Inventory upon request or may be seen in Room 709, Petroleum Bldg. at Houston. Mrs. Byron Boatright, Phone HO 5-5687, or write: 11315 Smithdale Road, Houston 24.

REAL ESTATE

INDUSTRIAL PROPERTY, Farmington, N. M., 300 Ft. by 300 Ft. improved with Shop and Office Building. Centrally located. Box K-585, The Oil and Gas Journal, Tulsa, Oklahoma.

RANCH located in colorful Santa Cruz Valley. This beautiful old Spanish Territory land provides a most entrancing atmosphere for comfortable ranch life. Over 1,000 acres of fertile valley with plenty of water, located between the Nogales Highway and the majestic Santa Rita Mountains in Southern Arizona. Owner will take home or other property in trade if located in southwestern states. Send for brochure with full details. Phone or Write to Fred H. Loveday, c/o Beal Realty, Realtor, 2917 E. Grant Road, Tucson, Ariz. Phone—EA 5-2678, EA 6-1833 Eves.

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containing 9800 square feet, completely air-conditioned, at 2434 Holmes Road, Houston, Texas, with 20.70 acres (surface only) 850 feet highway frontage. Also shop buildings and pipe racks. Private railroad trackage extending entire length of tract. Ample water supply.

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HOUSTON, TEXAS
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CA—5-3141, EXT. 460.

PRODUCTION FOR SALE

230 ACRES Montgomery County Kansas, one well 600' excellent equipment 17 ft. sand. Development opportunity—$1500.00—Rodney Dimick—Hamilton, Kansas.

PRODUCTION WANTED

WANTED: Oil properties, 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

DEVELOPED Primary Producing Properties are needed by principals. Submit production history, location, and asking price for quicker evaluation. Preference for properties in Kansas, Oklahoma, Texas, Illinois or Arkansas. Graybol Oil Corporation, NBT Building, Tulsa, Oklahoma.

WANTED

Production

We are interested in buying producing oil properties including those with possibilities of additional development.

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PHONE CE 2-7581
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WANT PROD. Royalties, Production or Oil Co. Drill if deal is right. Eddie Fisher, 1135 W. Huntington Dr., Arcadia, Calif.

WE WANT producing royalties, producing oil & gas properties, also farmouts gas acreage. Ben H. Williams — Clarendon, Texas.

HAVE EXCELLENT market for producing royalty. Prefer a developed or partially developed field. R. E. Clement, Box 65, Norman, Oklahoma.

LEASE AND DRILLING BLOCKS

FOR SALE—160-acre Producing lease depth 1200 to 2500 ft. More locations to drill. Bill Mashunkashey, Box 365, Pawhuska, Okla.

FOR SALE BY OWNER working interest and operational management in leases and 19 wells producing from 2500 foot zone; also interests in other properties. Box K-541, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

FOR QUICK SALE, 2/3 working interest for only $400 per ⅛ to drill shallow Pitkin lime well on virgin pool near Coweta in proven area. P. O. Box 315, Coweta, Okla.

NOTICE OF SALE BY TRUSTEE IN DISSOLUTION OF CORPORATION OF PRODUCING ROYALTY INTERESTS IN CADDO COUNTY, OKLAHOMA.

NOTICE IS HEREBY GIVEN that on the 4th day of April, 1958, at the hour of 2:00 o'clock P.M., in the foyer of the Court House in the City of Alva, Woods County, Oklahoma, the undersigned will sell to the highest and best bidder for cash, subject to confirmation of the District Court of Woods County, Oklahoma, all of the right, title and interest of the Enid Drilling Company, dissolved, in and to the following mineral interests under the real estate described, which are now producing oil:

1. An Undivided 4/40ths mineral interest in and under the Northwest Quarter (SW¼) of the Southwest Quarter (SW¼) of Section Four (4), Township Five (5) North, Range Nine (9), W.I.M., Caddo County, Oklahoma.
2. An undivided 4/100ths mineral interest in and under the west Half (W½) of the Southeast Quarter (SE¼), and the West Half (W½) of the Southeast Quarter (SE¼) of the Southeast Quarter (SE¼), of Section Four (4), Township Five (5) North, Range Nine (9), W.I.M., Caddo County, Oklahoma.

The foregoing interests were adjudicated as being owned by said corporation by judgment in the case of W. L. Thatcher vs. Matie B. Glasgow, et al., No. 16,828, District Court of Caddo County, Oklahoma, on March 12th, 1954, and sale of such mineral interests is being made by the undersigned Trustee pursuant to Order of the District Court of Woods County, Oklahoma, entered January 15th, 1958, in The Matter of the Dissolution of the Enid Drilling Company, a Corporation, No. 10,748.

DATED February 19th, 1958.

JOHN B. DOOLIN, TRUSTEE.
Office: Alva State Bank Building
Alva, Oklahoma.

SCOUTING

FOLLOW LAKE ERIE and adjoining inland activity; Ohio, Pennsylvania, New York. On the spot weekly report, $6.00 per month, $60.00 per year. South Shore Scouting Service, Box 355, Erie, Pa.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 3,443.52 acres of land in seven parcels within the known geologic structure of South McCallum Field in Jackson County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., April 8, 1958, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. John L. Rankin, Manager.

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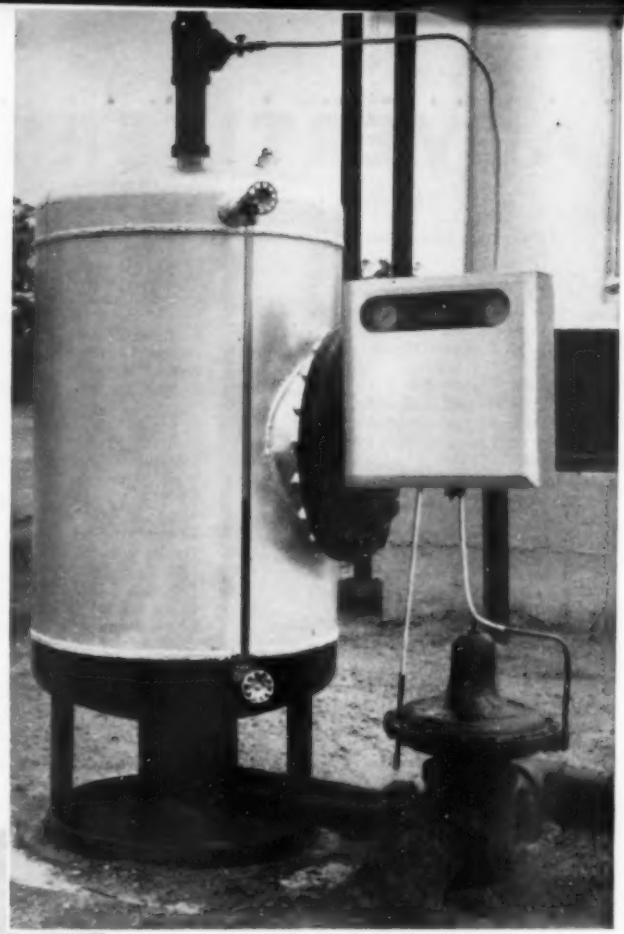

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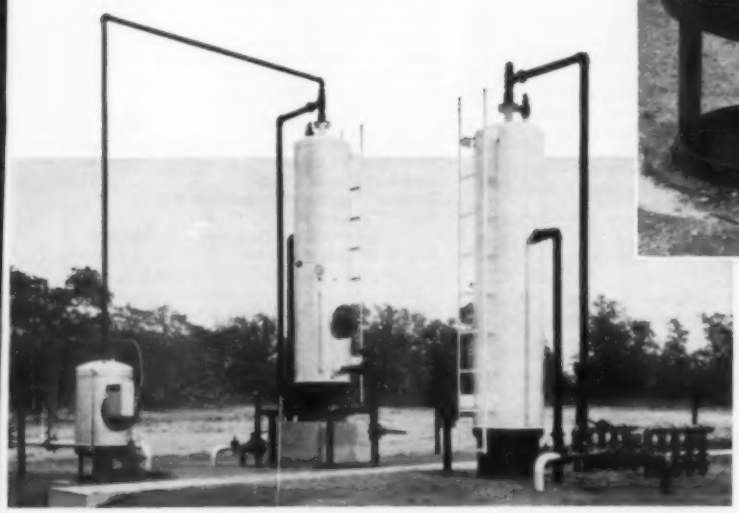
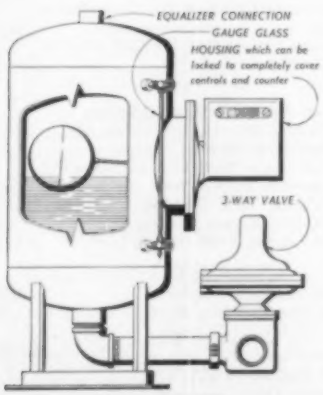


1 bbl. capacity Liqua-Meter and two National 2½′ x 10′ 2IF Separators — one on the left used as test separator.



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